SELECTED WATER RESOURCES ABSTRACTS

VOLUME 4, NUMBER 24
DECEMBER 15, 1971

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UNIVERSITY OF KENTUCKY
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WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency, Water Quality Office. A directory of the Centers appears on inside back cover.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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02 WATER CYCLE
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SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

BUBBLE COALESCENCE AND GAS TRANSFER IN AQUEOUS ELECTROLYTIC SOLUTIONS,
Maine Univ., Orono. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 05G.
W71-13282

A NOTE ON THE SOLUBILITY OF OXYGEN IN WATER,
New Brunswick Univ., Fredricton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02K.
W71-13508

02. WATER CYCLE

2A. General

LARGE-SCALE OSCILLATORY MOTIONS AND SEASONAL TEMPERATURE CHANGES IN LAKE MICHIGAN AND LAKE ONTARIO,
Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.
For primary bibliographic entry see Field 02H.
W71-13178

SYNTHETIC STREAMFLOWS,
Harvard Univ., Cambridge, Mass.
M. B. Fiering, and B. B. Jackson.
Available from AGU, Suite 435, 2100 Pennsylvania Ave., N.W. Wash. D.C. 20037 - $2.00. Geophysical Union Water Resources Monograph Series 1, Washington, D.C., 1971. 98 p, 14 fig, 4 tab, 54 ref.

Descriptors: *Synthetic hydrology, *Systems analysis, *Operations research, *Simulation analysis, *International Hydrological Decade, Model studies, River systems, Statistics, Mathematical studies, Markov processes, Dynamic programming, Reservoir operation, Surface groundwater relationships, Radioactive waste disposal.
Identifiers: *Operational hydrology, Hydrologic design.

The first of a series of monographs emphasizing procedural aspects of hydrologic analysis designated as U.S. contributions to the IHD, this monograph summarizes many of the proposals for generating synthetic streamflows, presents numerical examples that show step-by-step calculations, and offers proposals for application of synthetic hydrology in a variety of problems. This manual of practice is intended for those actively engaged in hydrologic design. Following brief background statements on operational hydrology and the role of decision theory, the authors discuss the statistics used in operational hydrology, evaluation of the statistics, the choice of a model, and several other considerations in the use of operational hydrology. Several case histories are given of application of stochastic streamflow simulation to real situations. These include planning of reservoirs in the St. Louis area, a technical assistance program to relieve waterlogging and salinity of agricultural lands in the Punjab region of West Pakistan, the disposal of radioactive wastes in streams as applied to the Clinch River in Tennessee, and a study of the Delaware River basin. (Lang-USGS)
W71-13289

PRECIPITATION DEPTH-DURATION-FREQUENCY RELATIONS FOR THE SAN FRANCISCO BAY REGION, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02B.
W71-13467

GEOMORPHOLOGY OF UPPER BASIN REACHES OF THE KOLYMA RIVER (Geomorfologiya basseyna verkhov'yev r. Kolymy),
Akademiya Nauk SSSR, Novosibirsk. Institut Geologii i Geofiziki.
Z. M. Khvorostova.
Izdatel'stvo 'Nauka', Sibirskoye Otdeleniye, Novosibirsk, USSR, 1970. 200 p.

Descriptors: *Geomorphology, *River basins, *Topography, *Geology, Land forming, Terrain analysis, Stratigraphy, Geologic time, Structural geology, Orography, Terraces (Geological), Deltas, Valleys, Rivers, Alluvium, Slopes, Glaciers, Erosion, Placer mining.
Identifiers: *USSR, Khabarovsk Kray, Yakutsk ASSR, Kolyma River, Placers, Tectonics, Regionalization, Land uplift.

The morphostructural and morphosculptural characteristics of upper basin reaches of the Kolyma River (Northeast USSR) were examined in connection with a study of the relief of the basin area. Four stages in the geological development of the relief were distinguished: (1) the geosynclinal (Carboniferous-Late Jurassic); (2) the orogenic (Early Cretaceous-Senonian); (3) the stage of relative tectonic stabilization (Danian-Eocene); and (4) the neotectonic stage of mountain formation (Oligocene-Holocene). The basic geomorphological features of the area were formed in the neotectonic stage, which was characterized by a regional uplift of the Yano-Kolymsk fold formations and by a dissection of the Danian-Paleogene surface. The relicts of this surface represent the most ancient elements of the relief. The geomorphological regionalization of the area was based on a detailed examination of spatial changes in glacial, fluvial and slope features of the relief. The geomorphological characteristics examined were used to define general patterns in the formation and evolution of placers. (Josefson-USGS)
W71-13502

MECHANICS OF SHEET FLOW UNDER SIMULATED RAINFALL,
Illinois Univ., Urbana. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-13798

MODELING THE INFILTRATION COMPONENT OF THE RAINFALL-RUNOFF PROCESS,
Minnesota Univ., St. Paul. Water Resources Research Center.
For primary bibliographic entry see Field 02G.
W71-13806

2B. Precipitation

APPLICATIONS OF CLIMATOLOGY AND METEOROLOGY TO HYDROLOGIC SIMULATION,
Texas A and M University, College Station.
Gary E. O'Connor and Robert A. Clark.
Technical Report No. 38, Texas Water Resources Institute, June, 1971, 127 p, 23 fig, 12 tab, 34 ref, 2 append. OWRR Project A-016-TEX (1).

Descriptors: *Data collections, *Climatic data, *Meteorology, Hydrologic data, Precipitation (Atmospheric), Evaporation, Streamflow, Texas, Operations research, *Distribution patterns, *Simulation analysis, *Synthetic hydrology, Artificial precipitation.

The normal, log-normal, square-root-normal, and cute-root-normal frequency distributions of hydrometeorological data, viz., precipitation, evaporation, and streamflow, were studied for selected regions of Texas. The regions were: East Texas, South Central Texas, and the Low Rolling Plains. These frequency distributions can be used to generate synthetic sequences of hydrometeorological data by simulation techniques of operations research. Results of this research show precipitation data in all regions conform to the square-root-normal distribution; streamflow data conform to the log-normal distribution; and evaporation data conform to all of the frequency distributions tested. Additionally, the streamflow and precipitation data were fitted to the Gumbel extreme-value and to the log-Pearson type III distributions. When monthly series of the data were used, both streamflow and precipitation data fit the log-Pearson type III distribution more adequately than the Gumbel distribution. Monthly series of evaporation data were fitted to the Gumbel distribution only and conform very well. (Author)
W71-13150

WEATHER MODIFICATION,
Resources Research Centre, Ottawa (Ontario).
For primary bibliographic entry see Field 03B.
W71-13165

SPLASH DROPLET PRODUCTION BY WATERDROP IMPACT,
Agricultural Research Service, Morris, Minn. Soil and Water Conservation Research Div.
C. K. Mutchler.
Water Resources Research, Vol 7, No 4, p 1024-1030, August 1971. 5 fig, 3 tab, 3 ref.

Descriptors: *Impact (Rainfall), *Raindrops, *Particle size, *Statistics, Erosion, Laboratory tests, Simulated rainfall, Soil erosion, Depth, Velocity, Energy.
Identifiers: *IRaindrop energy, *Splash droplets, *Draindrop splash.

Splash droplets produced by waterdrop impact were described by the normal distribution parameters derived on a volume basis. The major splash variables of surface water depth d and waterdrop diameter D were examined by using the distribution parameters: D50, the droplet diameter when 50% of the splash volume consists of larger droplets; the standard deviation; and N, the number of droplets produced by one waterdrop impact. For a waterdrop diameter of 0.4 cm, D50 was about 0.04 cm near zero depth, reached a maximum size of 0.15 cm at d/D — 0.5, and then decreased to a constant size of less than 0.13 cm for d/D is greater than 3. Larger waterdrops produced larger splash droplets. (Knapp-USGS)
W71-13285

USE OF FLUORESCEIN TO MEASURE THE COMPOSITION OF WATERDROP SPLASH,
Agricultural Research Service, Morris, Minn.
For primary bibliographic entry see Field 07B.
W71-13288

THE DAILY CYCLE OF SUMMER RAINFALL IN SOUTH CAROLINA,
Clemson Univ., S.C.
H. Landers.
NTIS, Springfield, Va. 22151 -COM-71-00663. Price $3.00. National Oceanic and Atmospheric Administration Climatic Research Series No 11, May 1971. 25 p, 16 fig, 2 ref. (Also designated as Report NOAA-71051405). 5201104.

Descriptors: *Rainfall, *Rainfall dispoition, *Weather forecasting, *South Carolina, *Climatic data, Summer, Distribution patterns, Stochastic processes, Radar, Thunderstorms, Clouds, Weather data, Precipitation intensity, Statistical methods.
Identifiers: *Rainfall patterns (SC).

Use is made of the Charleston Weather Service Office radar data to depict and follow time and area changes in rainfall patterns. The radar data used are for one summer only, the summer of 1968. The summertime convective rainfall in South Carolina, in the form of showers and thunderstorms, has a definite daily cycle. The three-hourly sequence of radar maps suggests preferred areas for major cloud buildup and heaviest precipitation. Such

reas are generally accompanied by strong surface winds during the precipitation stage and sometimes by lightning strikes and/or hail. These areas of major activity also represent a hazard to aircraft. (Woodard-USGS)
W71-13448

SUMMER SHOWER PROBABILITY IN COLORADO AS RELATED TO ALTITUDE,
National Weather Service, Denver, Colo. Weather Service Field Office.
A. G. Topil.
National Oceanic and Atmospheric Administration Technical Memorandum NWS CR-43, May 1971. 5 p, 4 fig, 2 tab, 5 ref.

Descriptors: *Rainfall, *Probability, *Rocky Mountain Region, *Weather forecasting, *Colorado, Rainfall disposition, Summer, Precipitation intensity, Mathematical studies, Stochastic processes, Statistical methods, Distribution patterns, Climatic data.
Identifiers: *Rain-shower probability (Colo), Summer showers, Rainfall patterns.

Ten years of records, from 1959 to 1968, were used to determine rain-shower probability in Colorado as related to altitude. The study was limited to the months of July and August, as almost all precipitation during those months falls as showers. The Climatological Data for Colorado was used in finding the average number of days with precipitation (.01 inch or more) at 193 stations. Twenty-four hour probabilities were used. There is an increase in precipitation probability with altitude in Colorado averaging nearly 5 percent per thousand feet during July and August. There is also a variation of precipitation probability east and west of the Continental Divide, with the eastern stations averaging about 5% higher probability at all elevations. Also, western areas show an increase of shower activity in August as compared with July, whereas eastern drainage basins generally show a decrease in precipitation probability from July into August. (Woodard-USGS)
W71-13450

PRECIPITATION DEPTH-DURATION-FREQUENCY RELATIONS FOR THE SAN FRANCISCO BAY REGION, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
S. E. Rantz.
GPO. Washington, D.C. 20402-Price $2.75. Geological Survey Research 1971, Chapter C, Professional Paper 750-C, p C237-C241, 1971. 3 fig, 2 tab, 1 ref.

Descriptors: *Depth-area-duration analysis, *Duration curves, *California, Cities, Urbanization, Rainfall-runoff relationships, Slope stability, Erosion, Soil erosion, Scour, Runoff forecasting, Frequency analysis, Design storm, Design flood.
Identifiers: *San Francisco Bay Area (Calif), *Urban hydrology.

Precipitation depth-duration-frequency relations were derived for the San Francisco Bay region, California. The regimen of precipitation in the region is such that depth-duration-frequency characteristics for a site are closely related to the mean annual precipitation for that site. The depth-duration-frequency data are to be used as criteria for both local drainage design and the study of the stability of land slopes. The frequencies studied were those corresponding to recurrence intervals of 2, 5, 10, 25, 50, and 100 years; the durations studied ranged from 5 minutes to 60 consecutive days. Data for the shorter durations are required for local drainage design and also for the study of surface-erosion potential, with land slope and soil type as additional factors. Data for the longer durations, to be used in conjunction with land slope and soil and geologic factors, are needed for the study of land-slippage potential. (Knapp-USGS)
W71-13467

BACKGROUND AND ANOMALOUS CHLORIDE AND SULFATE RATIOS IN ATMOSPHERIC PRECIPITATION, (O fonovykh i anomal'nykh sootnosheniyakh khloridov i sul'fatov v atmosfernykh osadkakh),
Regional Sanitation and Epidemiological Station, Sverdlovsk (USSR).
L. I. Piskunov.
Akademiya Nauk SSSR Doklady, Vol 193, No 6, p 1388-1391, 1970. 2 fig, 2 tab, 24 ref.

Descriptors: *Precipitation (Atmospheric), *Chemistry of precipitation, *Geochemistry, *Chlorides, *Sulfates, Salts, Atmosphere, Seasonal, Air pollution.
Identifiers: *USSR, European USSR, Baltic Sea, Caucasus, Urals.

The chemical composition of atmospheric precipitation varies with the geographic zone, the duration and form of precipitation, the season, the influence of human activity and various other factors. To study the natural geochemical background in the atmosphere, an analysis was made of the various chloride and sulfate concentrations in the precipitation over different regions of the USSR. Based on an empirical equation, a background chloride and sulfate ratio was established for atmospheric precipitation and for the troposphere. The formulas cited are applicable to observations made in the Baltic region, the Northwest and North European USSR, the South European USSR, the northern Caucasus and the central Urals. The anomalous ratios of chlorides and sulfates in atmospheric precipitation may be due to three factors: (1) chloride transport from the ocean; (2) weather conditions; and (3) local industrial pollution of the atmosphere. The dynamic variation of background chloride and sulfate ratios may be considered as regional pollution of the atmosphere resulting from increased human activity. (Josefson-USGS)
W71-13500

COSMOGENIC Na22 IN SURFACE WATERS OF ARID REGIONS (Kosmogennyy Na22 v poverkhnostnykh vodakh sushi),
Akademiya Nauk SSSR, Leningrad. Institut Evolyutsionnoi Fiziologii i Biokhimii.
For primary bibliographic entry see Field 02H.
W71-13501

RAINFALL CORRELATIONS IN THE PASTORAL ZONE OF EASTERN AUSTRALIA,
University of New England, Armidale (Australia). Dept. of Economic Statistics.
J. R. Anderson.
Australian Meteorological Magazine, Vol 18, No 2, p 94-101, June 1970. 1 fig, 2 tab, 5 ref.

Descriptors: *Rainfall, *Semiarid climates, *Correlation analysis, *Climatic data, *Spatial distribution, Distance, Regression analysis.
Identifiers: *Australia, *Isopleths.

Rainfall averages 20 inches or less per year in eastern Australian pastoral regions. Additionally, rainfall variability is high, leading to extreme variability of production and income. A possible strategy in reducing such variability is spatial diversification so that at least some parts of a stock operation enjoy the benefits of a high rainfall year. To test this possibility, simple correlations were made between monthly and yearly rainfall data for 11 stations over 40 years. Initial results led to simple correlations between square roots of monthly and annual rainfalls for 42 stations. A more compact quantification procedure then considered the impacts of distance or direction alone. Correlations of rainfall decrease at a diminishing rate with distance from a master station. There is an additional directional effect, with correlation decreasing most rapidly in an E-W direction. (Casey-Arizona)
W71-13571

ANOMALIES IN THE LARGE-SCALE ANNUAL WATER BALANCE OVER NORTHERN NORTH AMERICA,
Toronto Univ. (Ontario); and Canterbury Coll. Windsor (Onario).
F. K. Hare, and J. E. Hay.
Canadian Geographer, Vol 15, No 2, p 79-94, 1971. 10 fig, 2 tab, 27 ref.

Descriptors: *Precipitation (Atmospheric), *Water balance, *Hydrologic budget, *Runoff, *Evapotranspiration, Snowfall, Alaska, Solar radiation, Climatic data, Hydrologic equation.
Identifiers: *Canada, *Net radiation, *Dryness ratio, *Bowen ratio.

The mutual consistency of the climatological mean annual balances of Canada and Alaska are examined. Data obtained were annual fields of precipitation and runoff based directly on observations; of small-lake evaporation, based on conversions from pan observations, and on correlations with radiation; and of net radiation, derived from semi-empirical models incorporating limited amounts of direct observations. Spatially smoothed fields of these mean annual balances were obtained with the aid of the general balance relationships for water and energy at the Earth's surface. Comparisons of the charts show critical incompatibilities, suggesting the published fields of mean annual precipitation and runoff are inconsistent, and hence lead to spurious estimates of the eddy heat flux and evapotranspiration. On the basis of limited recent observations it is thought likely that the precipitation figures are too low because of errors in snowfall measurement. A determined effort must be made to calculate the true water content of the precipitation over Canada and Alaska because of the great economic and political importance of the disposable annual surplus. (Casey-Arizona)
W71-13581

CYCLIC SALT AND PLANT HEALTH,
Department of Primary Industries, Brisbane (Australia).
For primary bibliographic entry see Field 02I.
W71-13582

STRATOSPHERIC CIRCULATION AND SUMMERTIME RAINFALL OVER SOUTHERN NEW MEXICO AND SOUTH-WESTERN TEXAS,
National Weather Service, El Paso, Tex; and Texas Univ., El Paso.
E. V. Jetton, H. S. Oey, and C. E. Woods.
Weather, Vol 26, No 5, p 186-191, May 1971. 5 fig, 4 tab, 6 ref.

Descriptors: *Rainfall, *Arid lands, *Winds, *Meteorological data, Data collections, Diurnal, Seasonal, New Mexico, Texas, Air circulation, Precipitable water.
Identifiers: *Stratosphere, *Zonal flow, *Rocketsondes.

Rainfall over the SW has a markedly seasonal distibution reaching a maximum in July, August and September. During those months a moisture-laden, lower-level wind flow reaches the area from the Gulf of Mexico. This paper explores the possibility of a general relationship between stratopause layer (45-60 km) zonal flow and summertime rainfall over SW Texas and southern New Mexico. Six years daily rainfall data from 6 weather stations and 6 years stratospheric zonal flow (SZF) data from rocketsondes were analyzed. Analysis indicates that rainfall occurred 2-3 times as often on the decelerating phases of SZF as on the accelerating phases, and that over 90% of the more widespread rains either begin or undergo sharp increases during the decelerating phase. It is felt that these high-level atmospheric perturbations may be the critical difference between rain or no rain or between light vs. extremely heavy rain. (Casey-Arizona)
W71-13584

TOPOGRAPHY-CONDITIONED VARIATIONS IN RAINFALL AS RELATED TO THE RUNOFF-CONTRIBUTING AREAS IN A SMALL WATERSHED,
Hebrew Univ., Jerusalem (Israel).
D. Sharon.
Israel Journal of Earth - Sciences, Vol 19, No 2, p 85-89, 1970. 3 fig, 1 tab, 11 ref.

Descriptors: *Rainfall, *Topography, *Watersheds, *Arid lands, Lithology, Microclimatology, *Runoff, Wind velocity, Variability, Geomorphology, Rain gages.
Identifiers: *Fluviomorphology.

The amount of rainfall in watersheds is usually expressed as a single representative value or as a network mean. The small-scale pattern of variations within an area have been studied to a lesser extent, but recent watershed research indicates that such areal variations may be quite important. Information regarding the amount of rainfall reaching various portions of a watershed are important from 2 points of view: the hydrological, involving the theory of partial area contribution to runoff, and the fluviomorphological, which concerns the possible effect of nonuniform rainfall on the composition of sediment load carried by stromflow. Recent studies on small watersheds have shown that runoff did not necessarily originate from entire watershed areas, but rather from small, relatively consistent source areas. The areal pattern of rainfall was studied in the extremely arid, topographically rugged 1 sq. km. Ya'el watershed near Elat, Israel (January 1968 - May 1969). Seven storms with more than 2 mm rainfall occurred and a persistent variation in rain amount was noted, with relative abundance of rain in the low-lying channel portions. Essentially an average increase of 40 - 50% was found in that part of the watershed which in other areas has been found to be the major source of runoff. (Casey-Arizona)
W71-13590

THE ORIGIN OF FIXED NITROGEN IN THE ATMOSPHERE,
Negev Inst. for Arid Zone Research, Beersheka (Israel); and Groundwater Research Centre, Jerusalem (Israel).
For primary bibliographic entry see Field 02K.
W71-13591

EXCHANGE OF CO2 BETWEEN THE OCEAN AND THE ATMOSPHERE IN THE EASTERN SOUTH ATLANTIC,
Akademiya Nauk SSSR, Kaliningrad. Institut Okeanologii.
For primary bibliographic entry see Field 02K.
W71-13618

EXCHANGE OF SO2 BETWEEN THE ATMOSPHERE AND NATURAL WATERS,
University of East Anglia, Norwich (England). School of Environmental Sciences.
For primary bibliographic entry see Field 02K.
W71-13623

PRECIPITATION MODIFICATION,
National Water Commission, Arlington, Va.
For primary bibliographic entry see Field 03B.
W71-13873

EFFECT OF EXCESSIVE-RATE RAINSTORMS ON EROSION,
Agricultural Research Service, Holly Springs, Miss. North Mississippi Branch Experiment Station.
For primary bibliographic entry see Field 02J.
W71-13912

2C. Snow, Ice, and Frost

SOME LIMNOLOGICAL OBSERVATIONS FROM ENDERBY LAND, ANTARCTICA,
Lehigh Univ., Bethlehem, Pa. Central Marine and Environmental Studies.
E. E. Mac Namara.
Limnol Oceanogr. 15 (5): 768-775, Illus, Maps, 1970.
Identifiers: Antarctica, Dynamics, Enderby, Lakes, Land, Limnological, Melt, Ponds, Pools, Primary, Production, Seasonal.

The physical and chemical properties of freshwater lakes, ponds, and melt pools of coastal ice-free areas of Enderby Land, Antarctica, and their seasonal dynamics, are discussed. The waters are significantly less mineralized than has been reported in other ice-free areas of the antarctic. Tentative explanations for the divergencies are the location of the area with respect to storm tracks and the true melt-water nature of the lakes. Primary production was variable and dependent on many factors, including seasonal temperature cycles in the water bodies.--Copyright 1971, Biological Abstracts, Inc.
W71-13103

THE VEGETATION OF THE AINOVY ISLANDS,
N. S. Parfent'eva.
Tr Kandalaksh Gos Zapovednika. 7. 413-424. 1969. (Translated from Ref Zh Biol, 1970, No. 7V569.).
Identifiers: Ainovy, Bog, Chamomile-D, Colonies, Crowberry-D, Dock-D, Fern-P, Foxberry-D, Gull, Islands, Lichen, Marine, Meadows, Puffin, Salix-Glauca-D, Sedges,-M, Tundra, USSR, Vegetation, Zoogenic.

The Greater and Lesser Ainovy Islands are located near Pechenga Bay in the White Sea. Their flora and vegetation formed under the influence of a polar marine climate which is moderated by the nearby Gulf Stream. The plant cover consists of 4 types; tundra, bog, marine meadow, and zoogenic vegetation. Tundra develops on peat tundra soils (crowberry-lichen and crowberry-foxberry tundras) and peat deposits of considerable thickness (fern-crowberry-cloudberry and crow-cloudberry tundras and their variants). The latter are more widespread and are represented by complexes of small flat-topped mounds with bushes and ferns between the mounds. Bogs occupy dry gulches and depressions near lakes and terraces. Lowland-type bogs predominate, with formations of water sedge, cottongrass, and Salix glauca; transitional and upland types are found making slight penetrations into other types; complex flat-topped mound bogs are transitional from the bog type to the tundra type. There is a characteristic absence of halophilic species in marine meadows but there is dominance of the stands of herbage by grasses and mixed herbage and this differentiates them from the shore meadows. Zoogenic vegetation replaces areas of tundra and bog types under the influence of colonies of gulls and puffins. Characteristic coenoses are those of chamomile, dock, and, in moister places, French willow. The islands should probably be separated out into an independent geobotanical subregion of the region of Kil'din Island and the Rybach'ii Peninsula.--Copyright 1971, Biological Abstracts, Inc.
W71-13138

CONSTRUCTION OF EARTH DAMS ON PERMAFROST SOILS,
For primary bibliographic entry see Field 08D.
W71-13153

A PILOT STUDY OF WEATHER, SNOW, AND AVALANCHE REPORTING FOR WESTERN UNITED STATES,
Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.
A. Judson.

Reprint from Ice Engineering and Avalanche Forecasting and Control, 6th Conference on Snow and Ice, Calgary University, Canada, Oct 1969: National Research Council of Canada Technical Memorandum 98 p 123-134, 1970. 4 fig.

Descriptors: *Avalanches, *Data collections, *Instrumentation, *Meteorological data, *Snowpacks, Weather data, Networks, Forecasting, Hazards, Winds, Temperature, Data processing, Precipitation gages.
Identifiers: *Avalanche forecasting.

The present U.S. Forest Service weather, snow, and avalanche data network consists of 42 mountain stations where snow avalanches are observed and controlled each winter. At 21 of these areas, the avalanche problem is rated serious. Avalanche specialists at many of these high hazard areas make additional observations on weather and snow conditions, which determine when traffic restrictions are needed and avalanche control action is necessary. Only 10 of the higofhazard areas have the full complement of instruments. Reporting stations located in 11 Western States and Alaska cover 25 degrees of latitude. The network represents a wide variety of weather, snow, and avalanche conditions. Station elevations vary from near sea level in coastal Alaska to 3,450 m in the central Rockies. The observation sites are close to the zone of maximum precipitation in their respective ranges, and the first two winters of operation have produced an interesting set of data. The primary objectives of the pilot network are: to determine the practicability of providing the basic weather, snow, and avalanche information needed for day-to-day avalanche control, and to generate the long-term records needed to develop an avalanche danger rating scheme. (Knapp-USGS)
W71-13294

BREAKUP CHARACTERISTICS IN THE MOUTH AND LOWER REACHES OF THE YENISEY RIVER,
A. P. Burdykina.
Soviet Hydrology: Selected Papers, No 1, p 42-56, 1970. 4 fig, 13 tab, 10 ref. Translated from Trudy Arkticheskogo i Antarkticheskogo Nauchno-Issledovatel'skogo Instituta (AANII), Vol 290, p 34-55, 1970.

Descriptors: *Ice breakup, *Ice jams, *Rivers, *Flood forecasting, Heat budget, Rainfall-runoff relationships, Regime, Floods, Streamflow, Ice, Weather forecasting, Climates.
Identifiers: USSR, Yenisey River.

A method for forecasting ice cover destruction uses data on the thermal state of the air masses, radiation, time of approach of the flood wave, rate of rise in river level, and snow cover depth. The combined effect of these natural factors on the ice regime of bodies of water in the Yenisey region of the USSR is very complex and can be determined only by approximation. Among the elements of the hydrologic regime, the mechanical flood factor plays the primary role in the breakup of the lower reaches of the Yenisey. The flood wave energy and the heat carried by the river water play nearly the same role in the northeastern half of the estuary, while the thermal state of the river waters with some participation of the high-water flow affect the ice in the northwestern part of the estuary, where the flood wave energy acts on the shore ice at the beginning of the process, and the thermal factor takes over later. (Knapp-USGS)
W71-13295

ESTIMATION OF DESIGN FREEZING INDICES,
Hardy (R. M.) and Associates Ltd., Edmonton (Alberta).
G. McCormick.
ASCE Proceedings, Transportation Engineering Journal, Vol 97, No TE 3, Paper 8276, p 401-409, August 1971. 9 fig, 1 tab, 10 ref, append.

Descriptors: *Frost, *Freezing, *Climatology, Frozen ground, Highways, Weather data, Meteorological data, Forecasting, Data collections.
Identifiers: *Freezing index, *Canada.

A method is given for arriving at a rational estimate of the design freezing index for any place on the Canadian Prairies. A correlation between mean annual temperature, mean freezing index, and 25 yr, 50 yr and 100 yr freezing indices is demonstrated. The method is applicable to any area with a continental climate. (Knapp-USGS)
W71-13445

CHEMICAL WEATHERING AND GLACIAL EROSION OF CRYSTALLINE ROCKS AND THE ORIGIN OF TILL,
For primary bibliographic entry see Field 02J.
W71-13455

GEOGRAPHIA POLONICA.
Polish Academy of Sciences, Warsaw. Inst. of Geography.
For primary bibliographic entry see Field 02J.
W71-13488

SOME REMARKS ON THE ORIGIN OF DRUMLINS,
Wroclaw Univ. (Poland). Inst. of Geography.
For primary bibliographic entry see Field 02J.
W71-13490

POSITION OF BOULDER CLAY AMONG OTHER SEDIMENTARY ENVIRONMENTS BASED ON SOME GRAIN ABRASION PARAMETERS,
Adam Mickiewicz Univ., Poznan (Poland). Inst. of Geography.
For primary bibliographic entry see Field 02J.
W71-13492

SELECTED PROBLEMS OF LITHOLOGY AND PETROGRAPHY OF THE BOULDER CLAYS IN CENTRAL AND EASTERN POLAND,
Geological Inst. Szczecin (Poland). Dept. of Sea-Coast Geology.
For primary bibliographic entry see Field 02J.
W71-13493

NONHOMOGENEOUS STRAIN STUDIES ON ANTARCTIC GLACIERS,
Ohio State University, Columbus. Inst. of Polar Studies.
T. Hughes.
Antarctic Journal U.S., Vol 6, No 4, p 89-90, July-August 1971. 3 fig, 3 ref.

Descriptors: *Glaciers, *Movement, *Antarctic, *Rheology, Shear, Strain, Regimen, Volcanoes, Craters.

Evidence for nonhomogeneous strain exists in Antarctica as shear bands in a Deception Island glacier exposed internally during a volcanic eruption in 1970, and as a surface wave train on Meserve Glacier in Wright Valley, south Victoria Land. Lying at the very tip of the glacier and slightly to one side of the central flowlines, the crater has exposed annual dirt layers and ash layers from previous eruptions. It is being closed by ice flowing inward from all sides as predicted by the theory for contraction of a cylindrical hole. Near the snout the glacier is apparently frozen to its bed, and ice flowing inward has generated a bending moment that is shearing the ice along steeply rising surfaces that intersect the crater wall at acute angles. Shear appears largely confined to either individual planes or to narrow bands, and the amount of shear can be measured from the displacement of dirt and ash layers that intersect the shear surfaces. Air bubbles are often elongated in the direction of flow and generally aline parallel to the annual dirt layers. However, when these layers intersect shear surfaces, the air bubbles become elongated in the shear direction for wide shear bands but not for narrow shear bands. This indicates that wide bands formed slowly and that narrow bands formed rapidly. Apparently, two mechanisms contribute to the formation of surface wave trains on dry-valley glaciers: an instability mechanism activated during the antarctic winter for glaciers having ice falls, and a differential ablation-longitudinal compression mechanism that operates on glaciers that have ogives and flow northward. (Knapp-USGS)
W71-13622

BUBBLE COALESCENCE IN ICE AS A TOOL FOR THE STUDY OF ITS DEFORMATION HISTORY,
Cold Regions Research and Engineering Lab., Hanover, N.H.
J. Weertman.
Journal of Glaciology, Vol 7, No 50, p 155-159, June 1968. 2 fig, 10 ref.

Descriptors: *Ice, *Glaciers, *Rheology, *Bubbles, *Strain measurement, Temperature, Plasticity, Viscosity, Stress, Regimen, Deformation.
Identifiers: Bubble coalescence.

The rate of bubble coalescence in a deforming ice mass was analyzed. A total strain of at least 8 is required before appreciable coalescence occurs. The analysis was applied to deforming ice shelves and ice sheets. No appreciable coalescence is expected in ice shelves but coalescence should occur in ice sheets (or glaciers) if the shear strain-rate at the bottom surface is of the order of 0.075/year or larger. Measurements of bubble concentration can set limits on paleo-strain-rates of present ice sheets. Bubble migration down temperature gradients presents complications to the study of bubble coalescence. (Knapp-USGS)
W71-13632

DIFFUSION LAW FOR THE DIFFUSION OF HARD PARTICLES IN AN ICE MATRIX THAT UNDERGOES SIMPLE SHEAR DEFORMATION,
Cold Regions Research and Engineering Lab., Hanover, N.H.
J. Weertman.
Journal of Glaciology, Vol 7, No 50, p 161-165, June 1968. 1 fig, 1 tab, 12 ref.

Descriptors: *Ice, *Diffusion, *Strain, *Glaciers, *Deformation, Strain measurement, Rheology, Stress, Regimen, Particle size, Temperature.

A diffusion equation describes the mechanical dispersion of a dilute mixture of solid particles within an ice matrix that is undergoing deformation. Within the limits of time intervals and strain-rates appropriate to the movement of glaciers and ice sheets, the dispersal distance usually is no larger than a distance about one order of magnitude greater than the size of the particles themselves. (Knapp-USGS)
W71-13633

BUBBLES AND BUBBLE PRESSURES IN ANTARCTIC GLACIER ICE,
Cold Regions Research and Engineering Lab., Hanover, N.H. Snow and Ice Branch.
A. J. Gow.
Journal of Glaciology, Vol 7, No 50, p 167-182, June 1968. 7 fig, 5 tab, 19 ref.

Descriptors: *Ice, *Bubbles, *Antarctic, *Rheology, Pressure, Strain, Plasticity, Viscosity, Stress, Deformation, Density, Sampling, Cryology, Crystallization, Crystal growth, Crystallography.
Identifiers: Bubbles in ice.

Application of the gas law to density measurements of ice samples from two deep drill holes at Byrd Station and Little America V, Antarctica, shows that density increase beyond the pore close-off density (0.083 g/cc) can be attributed to compression of the entrapped bubbles of air. By substituting the overburden pressure for the bubble pressure in the pressure-density relationship based on the gas law, ice densities below 200 m can be calculated more accurately than they can be measured on cores, because of the relaxation that occurs in samples recovered from high confining pressures. This relaxation, resulting in increase in the bulk volume of the ice with time, is generally attributed to decompression of the bubbles. There is, however, evidence for only negligible decompression of the bubbles. Most of this relaxation may be due to cracking. Anomalous bubble pressure-density relations at Little America V tend to show considerable deformation in the upper part of the Ross Ice Shelf. The observation that most of the bubbles assume substantially spherical shapes by 120 m depth points to essentially hydrostatic conditions in the upper layers of the ice sheet at Byrd station. (Knapp-USGS)
W71-13634

ON THE USE OF THE EQUILIBRIUM EQUATIONS AND FLOW LAW IN RELATING THE SURFACE AND BED TOPOGRAPHY OF GLACIERS AND ICE SHEETS,
Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
I. F. Collins.
Journal of Glaciology, Vol 7, No 50, p 199-204, June 1968. 2 fig, 9 ref.

Descriptors: *Glaciers, *Rheology, *Movement, *Strain, Stress, Equilibrium, Mathematical studies, Topography, Slopes, Ice, Viscosity, Plasticity.
Identifiers: Glacier movement.

A new method of calculating the relation between bed and surface topography of an ice sheet includes the effect of longitudinal strains in the equilibrium equation. An exact statement of the quasi-static equilibrium of the ice is derived in an integrated form. Two related assumptions are then made to reduce the problem to a readily tractable one-dimensional one. The relation between longitudinal stress (which is given a precise meaning) and strain-rate is derived, and the validity of the assumptions made is discussed. The two approximations necessary for the application of the method are: (a) the bed slope is small; and (b) the shear stress component is small compared with the normal stress difference when averaged throughout the ice thickness. (Knapp-USGS)
W71-13635

COMPUTATIONS OF THE POSSIBLE FUTURE BEHAVIOR OF BERENDON GLACIER, CANADA,
Washington Univ., Seattle. Dept. of Atmospheric Sciences.
N. Untersteiner, and J. F. Nye.
Journal of Glaciology, Vol 7, No 50, p 205-213, June 1968. 4 fig, 1 tab, 6 ref, append. NSF Grant GP-2971.

Descriptors: *Glaciers, *Regimen, *Movement, *Water balance, Forecasting, Temperature, Mathematical studies, Mining, Engineering geology, Climate, Rheology.
Identifiers: Glacial advances.

If the surface of Berendon Glacier, British Columbia, Canada, rose by 19 m above its 1963 level, at a point near the terminus it would interfere with the entrance to a mining tunnel. Computations were made to see whether this rise is likely. The changes in mass balance that would be necessary to make the glacier, which is now retreating, start to advance and reach the tunnel in 40 years and 20 years respectively were calculated. The method fits polynomials to the advance-retreat data and then infers the corresponding mass balance behavior. It is concluded that if the mean mass balance should increase smoothly to plus 70 cm/year, which is a high but possible value, by the year 2003 the ice would reach the tunnel portal. But, even assuming a rather drastic deterioration in the climate in the

future and a concomitant increase of the mean mass balance, the ice will not reach the tunnel portal within the next 20 years. (Knapp-USGS)
W71-13636

ON THE CALVING OF ICE FROM FLOATING GLACIERS AND ICE SHELVES,
Technical Univ. of Denmark, Copenhagen. Hydraulic Lab.
N. Reeh.
Journal of Glaciology, Vol 7, No 50, p 215-232, June 1968. 14 fig, 3 tab, 8 ref.

Descriptors: *Glaciers, *Icebergs, *Deformation, *Elastic theory, Sea ice, Movement, Deflection, Stress, Elastic deformation, Viscosity, Shear strength.
Identifiers: Calving (Glaciers), Floating glaciers.

The deformation and the state of stress in the frontal part of a floating glacier may be analyzed by a method analogous with the beam theory for determining stresses and deflections of a beam of an elastic material. Very rough approximations are used, the most severe being that of assuming the viscosity of the ice to be constant. Curves showing the progress in time of the deflections and the stresses in the frontal part of the glacier are given for the case of an infinitely wide glacier. The stresses are greatest at a cross-section situated at a distance of about the thickness of the glacier from the front, and the stresses are of a magnitude which very likely will lead to fracture, resulting in the formation of an iceberg. The magnitude of the icerbergs as well as the frequency of the calving is a function of the thickness, the density, and the temperature of the glacier. Observations from nature support the theory. Other calving mechanisms for floating glaciers are briefly discussed.
W71-13638

ALBEDO MEASUREMENTS OF AN ARCTIC ICE COVER FROM HIGH TOWERS,
McGill Univ., Montreal (Quebec). Dept. of Physics.
M. P. Langleben.
Journal of Glaciology, Vol 7, No 50, p 289-297, June 1968. 8 fig, 8 ref.

Descriptors: *Ice, *Arctic Ocean, *Albedo, *Heat budget, Solar radiation, Radiation, Melting, Snow, Snowpacks, Topography.
Identifiers: Radiometers.

Radiometers suspended at a height of 15 m between two towers anchored to the bottom of the Arctic Ocean ice cover, were used to measure the average or integrated albedo of the surface. The work was carried out in May 1967 at Tanquary Fiord, Ellesmere Island during the period when the surface of the ice cover was undergoing rapid change. The albedo was observed to have a value of almost 1.0, for a fresh snow cover, and about 0.8 for a weathered snow cover. It decreased to 0.6 as the wind partially cleared the surface of snow and gradually to 0.5 with further deterioration of the snow. The onset of melting, produced when the daily temperature exceeded 0 deg C, rapidly lowered the albedo to a value of about 0.3. (Knapp-USGS)
W71-13639

ON THE ORIGIN OF ABLATION HOLLOWS (POLYGONS) ON SNOW,
Wroclaw Univ. (Poland). Inst. of Geography.
A. Jahn, and M. Klapa.
Journal of Glaciology, Vol 7, No 50, p 299-312, June 1968. 12 fig, 14 ref.

Descriptors: *Snowpacks, *Ablation, *Melting, *Sediments, *Topography, Snow cover, Snowmelt, Dusts.
Identifiers: Snow polygons, Ablation polygons, Poland.

Ablation polygons on snow were examined, mainly in the Tatra Mountains, both by field observation and by experiment. The polygons are initiated under peculiar climatic conditions--mostly when the melting of snow is somewhat slow and is accompanied simultaneously by metamorphism. A thick snow cover seems to be a prerequisite of this process. A detailed analysis of the problem of dirt concentration in snow, due to ablation, reveals the major role played by adhesion in this process. The concentration of dirt is due to lateral movement of the material and this is intrinsically related to the microelements of the snow surface. The origin and development of ablation polygons do not depend on the presence of dirt in the snow, but the process of dirt concentration is dependent of the evolution of polygonal forms. (Knapp-USGS)
W71-13640

THE QUANTITY OF MELT WATER IN THE MARBLE POINT-GNEISS POINT AREA, McMURDO SOUND, ANTARCTICA,
Massachusetts Port Authority, Boston.
J. R. Davis, and R. L. Nichols.
Journal of Glaciology, Vol 7, No 50, p 313-320, June 1968. 8 fig, 7 ref.

Descriptors: *Runoff, *Glaciers, *Snowmelt, *Antarctic, *Melt water, Water balance, Temperature, Topography, Slopes, Ice, Discharge (Water), Runoff, Streamflow.
Identifiers: McMurdo Sound (Antarctica).

Among the important factors in the formation of melt water are: The air and soil temperatures; the presence or absence of debris on snow and ice; the surface gradients of the glaciers, which determine where melting can occur as well as the amount of insolation; and the orientation of snow and ice slopes. In general, in the Southern Hemisphere north-facing slopes receive more insolation than south-facing slopes. The main source of the melt water at McMurdo Sound is Wilson Piedmont Glacier, and the snowdrift-ice slabs are next in importance. The seasonal snowfall is not an important source, nor is the ice in the active zone. The discharge of the rivers of the area was roughly measured in 1957-58. It was found to be approximately 432,000 cu m. (Knapp-USGS)
W71-13641

MEASURED BETA ACTIVITY OF ALASKAN FIRN,
Ohio State Univ. Columbus. Dept. of Civil Engineering; and Ohio State Univ., Columbus. Inst. of Polar Studies.
T. H. Wu.
Journal of Glaciology, Vol 7, No 50, p 329-331, June 1968. 2 fig, 8 ref.

Descriptors: *Glaciers, *Radioactive dating, *Alaska, *Firn, *Fallout, Radioactivity techniques, Tracers, Tracking techniques, Sampling, Winds, Regimen, Water balance.
Identifiers: Juneau Ice Field (Alaska).

Firn profiles may be dated by means of stratigraphic interpretation, stable isotope ratio and fallout contamination from nuclear bomb tests. The use of radioactive fallout has the advantage that reference levels which correspond to years of especially heavy or low fallout may be established. The correlation must take into consideration the rate of fall-out and the global circulation pattern of the fission products. During the summer of 1963 and 1964 firn specimens were obtained from two sites on the Juneau Icefield in Alaska. The gross beta activity of these specimens was determined in an effort to date the firn strata. The measured beta activities of firn samples from two sites on the Juneau Icefield are in good agreement with each other and with those of Greenland firn. A consistent pattern of beta activity variation can be identified for the firn layers from 1959 through 1962. The 1952-53 firn layer cannot be identified from the measured beta activities. (Knapp-USGS)
W71-13642

DETERMINATION OF TEMPERATURE ON ICE CAPS BY SEISMIC METHODS,
Muenster Univ. (West Germany). Institut fuer Reine and Angewandte Geophysics.
F. Thyssen.
Journal of Glaciology, Vol 7, No 50, p 333-335, June 1968. 9 ref.

Descriptors: *Glaciers, *Temperature, *Seismic studies, Velocity, Melting, Firn, Ice, Cryology, Geophysics, Sounding, Seismic properties, Geothermal studies.

An empirical formula for the seismic velocities of P waves in glaciers and ice caps was used to determine the temperatures which can be deduced from the maximum and the mean vertical velocities. With the aid of several examples from previous publications, these temperatures are discussed and direct temperature measurements are compared with the derived temperatures. The agreement between the calculated and the measured temperatures indicates that the formula can be used for temperature estimation on inland ice sheets where no bore holes are available. (Knapp-USGS)
W71-13643

EFFECTS OF A DEBRIS SLIDE ON 'SIOUX GLACIER' SOUTH-CENTRAL ALASKA,
North Dakota Univ., Grand Forks. Dept. of Geology.
J. R. Reid.
Journal of Glaciology, Vol 8, No 54, p 353-367, October 1969. 9 fig, 1 tab, 19 ref. NSF Grant G-4448.

Descriptors: *Glaciers, *Regimen, *Landslides, Movement, Ablation, Ice, Rheology, Alaska, Water balance, Debris avalanches.
Identifiers: Sioux Glacier (Alaska).

The lower one-third of Sioux Glacier in south-central Alaska was buried beneath a debris slide during the 27 March 1964 earthquake. Investigations to determine the effect of this cover on the regimen of the glacier revealed that it has increased in thickness by as much as 28 m, primarily as a result of the insulating effect of this debris cover. In areas where debris has continuously veneered the surface, at least since 1938, the ice is also thicker. A longitudinal profile reveals that the area near the upper extent of the slide debris has become intensely crevassed and has been lowered as much as 8 m between 1965 and 1966, while the terminal area is up to 5 m higher and is characterized by thrusting. It is concluded that a kinematic wave passed through this glacier sometime between 1965 and 1966. The upper zone of debris-veneered ice is moving at 175 m/year while the terminal area is flowing at only 21 m/year. The rate of down-glacier decrease in velocity is about 0.06 m/year per meter of horizontal distance except for an area approximately 1 km from the terminus. Here, the rate of decrease in velocity is 0.1 m/year per meter. The change in rate is presumed to be related to topographic control caused by the recent thinning of the ice here. (Knapp-USGS)
W71-13644

ICE-RESISTIVITY MEASUREMENTS ON PARIS GLETSHER, EAST GREENLAND,
Imperial Coll. of Science and Technology, London, (England). Exploration Board.
M. C. Clark, M. H. Key and G. J. Pert.
Journal of Glaciology, Vol 8, No 54, p 369-373, October 1969. 2 fig, 2 tab, 9 ref.

Descriptors: *Electrical studies, *Glaciers, *Ice, *Resistivity, Electrical properties, Conductivity, Cryology, Electrical resistance, Geophysics, Melting, Temperature.
Identifiers: Greenland.

D. C. ice-resistivity measurements were made on the polar Paris Gletscher in East Greenland. The observed profile is well described by a four-layer system. Near the surface there are two layers resulting from the penetration of the summer tem-

peratures into the polar ice. Below this the ice has constant resistivity until the bed is reached, where contrary to expectation a high-resistivity layer is found. (Knapp-USGS)
W71-13832

FABRIC ANALYSIS OF SURFACE ICE NEAR CASEY RANGE, EAST ANTARCTICA,
Hokkaido Univ., Sapporo (Japan). Dept. of Geology and Mineralogy.
K. Kizaki.
Journal of Glaciology, Vol 8, No 54, p 375-383, October 1969. 7 fig, 3 tab, 13 ref.

Descriptors: *Petrofabrics, *Glaciers, *Antarctic, *Strain, Movement, Velocity, Crystallography, Particle size, Particle shape, Strain gages, Ice, Cryology.
Identifiers: Casey Range (Antarctica).

Forbes Glacier, one of the outlet ice streams from the Antarctic ice sheet, is located 20 km west of Mawson, Mac. Robertson Land, east Antarctica. In the uppermost part of the glacier near Casey Range, the velocity at the center of the glacier is 59 m/year and the strain-rate at seven strain grids ranges from-0.0063 to 0.0067/yr on the surface of the glacier. The fabric types of this area are characterized by single-maximum and small-girdle fabrics. The single-maximum fabric is an original pattern which changes gradually to a small girdle fabric about the maximum compressive axis in association with grain growth. (Knapp-USGS)
W71-13833

SURFACE TOPOGRAPHY OF ETCHED ICE CRYSTALS OBSERVED BY A SCANNING ELECTRON MICROSCOPE,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
D. Kuroiwa.
Journal of Glaciology, Vol 8, No 54, p 475-483, October 1969. 9 fig, 6 ref.

Descriptors: *Crystallography, *Ice, *Electron microscopy, *Cryology, Topography, Crystal growth, Laboratory tests, Evaporation.
Identifiers: Ice crystals, Scanning electron microscopes.

Surface topography of etched ice crystals was examined by a scanning electron microscope in combination with a Formvar replica method. The deep focus of the scanning electron microscope allowed observation of the sharply three-dimensional topography of ice surfaces. Various useful information was obtained from microphotographs of etched basal and prismatic planes, fractured surfaces, and grain boundaries formed between microcrystals of ice. (Knapp-USGS)
W71-13834

A FLOW MODEL AND A TIME SCALE FOR THE ICE CORE FROM CAMP CENTURY, GREENLAND,
Copenhagen Univ. (Denmark). Physics Lab.
W. Dansgaard, and S. J. Johnsen.
Journal of Glaciology, Vol 8, No 53, p 215-223, June 1969. 6 fig, 25 ref.

Descriptors: *Glaciers, *Movement, *Rheology, Plasticity, Cryology, Strain, Stress, Temperature, Melting, Pressure, Climates, Regimen, Stratigraphy, Dating, Radioactive dating.
Identifiers: Glacier flow.

A flow model is described for the Camp Century area in Greenland. The horizontal velocity profile along the core is assumed to be uniform from the surface down to y—400 m above the bottom. Below this level, the horizontal velocity vx is assumed to decrease proportionally to y. Furthermore, at a given y, vx is assumed to be proportional to the distance x from the ice divide. The resulting vertical strain-rate under steady-state conditions gives the age of the ice as a function of y. The flow model has explained the measured temperature profile, and the time scale has been verified by comparison between observed stable isotope variations and past climatic changes (at least 70,000 years back in time) estimated by other methods. (Knapp-USGS)
W71-13835

ATTENUATION OF SOUND IN SEA ICE, 10-500 kHz,
McGill Univ., Montreal (Quebec). Dept. of Physics; and McGill Univ., Montreal (Quebec). Ice Research Project.
M. P. Langleben.
Journal of Glaciology, Vol 8, No 54, p 399-406, October 1969. 4 fig, 9 ref.

Descriptors: *Sea ice, *Acoustics, *Mechanical properties, Geophysics, Sound waves, Sounding, Physical properties, Instrumentation, Elastic theory, Elastic deformation, Friction, Cryology.
Identifiers: Sonic studies, Sound attenuation.

Measurements of the attenuation of acoustic waves in sea ice at frequencies between 10 kHz and 500 kHz were made on the ice cover at Tanquary Fiord, Ellesmere Island. A horizontal transmission path at a depth of 4 ft, mid-way between the top and bottom surfaces of the ice cover, was used at ranges varying from 25 ft to 4 ft between piezoelectric transducers immersed in oil-filled bore holes. Over the frequency band covered, the linear behavior was predominant and the Rayleigh scattering relatively insignificant. (Knapp-USGS)
W71-13836

INVESTIGATIONS INTO THE MECHANICAL PROPERTIES OF ALPINE SNOW-PACKS,
Cold Regions Research and Engineering Lab., Hanover, N.H.
C. M. Keeler, and W. F. Weeks.
Journal of Glaciology, Vol 7, No 50, p 253-271, June 1968. 15 fig, 1 tab, 36 ref.

Descriptors: *Snowpacks, *Mechanical properties, *On-site tests, Shear strength, Bearing strength, Compressibility, Density, Sampling, On-site data collections, Montana, Equipment, Instrumentation.
Identifiers: Snow properties (Mechanical).

Data on the physical properties of seasonal alpine snow were collected from the Beartooth Mountains, Montana at about 3000 m and the Bridger Range at about 2200 m. Measurements were made of snow density, temperature, structure, ram and Canadian hardness, centrifugal tensile strength, and shear strength. A plot of ram number versus density gave a log-linear relation similar to that suggested for polar snows. Both shear-vane and centrifugal-tensile results, when plotted as a function of porosity, are well described by a negative exponential relation. Depth hoar and wet snow invariably have lower strength values at any density. Several field experiments were performed to study the sources of error in making in-situ mechanical tests on snow without utilizing a pit wall. The main factor contributing to the experimental scatter is lateral inhomogeneity in the snow cover. There was no significant difference between the results of different operators. The standard deviation of a group of strength tests is directly proportional to the mean value of the group. This indicates that a logarithmic transformation should be made in handling snow strength results in order to stabilize the variance. The systematic relations between snow properties invariably become obscured when different snow types are indiscriminately grouped together. (Knapp-USGS)
W71-13837

STRESS-GENERATED ICE CRYSTALS IN A NEARLY ISOTHERMAL TWO-PHASE SYSTEM,
Washington Univ., Seattle. Dept. of Atmospheric Sciences.
E. LaChapelle.
Journal of Glaciology, Vol 7, No 50, p 193-198, June 1968. 9 fig, 17 ref. Grant GA-466.

Descriptors: *Crystal growth, *Ice, *Glaciers, *Stress, Strain, Crystallography, Washington, Rheology, Temperature, Freezing, Melting, Heat transfer, Mass transfer.
Identifiers: Ice crystals.

A water-filled cavity intersected by a tunnel in nearly stagnant ice of the Blue Glacier, Washington State, U.S.A., was lined with large and unusual single ice crystals which apparently owe their origin to the effects of hydrostatic stress. Even the minute differences in pressure melting point around this cavity are adequate to remove the heat of fusion as ice forms within it. There is evidence that interstitial movement of melt water in the surrounding ice also contributes to the heat and mass transfer. The form of these crystals indicates that they grew into slightly supercooled water. It is suggested that this growth pattern is sustained by the existence of oriented stresses at the cavity walls. (Knapp-USGS)
W71-13838

THE COMPLEXITIES OF THE THREE-DIMENSIONAL SHAPE OF INDIVIDUAL CRYSTALS IN GLACIER ICE,
Cold Regions Research and Engineering Lab., Hanover, N.H.
G. P. Rigsby.
Journal of Glaciology, Vol 7, No 50, p 233-251, June 1968. 15 fig, 4 tab, 7 ref.

Descriptors: *Crystallography, *Ice, *Glaciers, *Particle shape, Cryology, Crystallization, Crystals, Sampling, Anisotropy, Optical properties, Particle size.
Identifiers: Ice crystals.

A block of ice from Blue Glacier, Washington, was successively sectioned at close intervals as a means of determining exact crystal shape in three dimensions. Two crystals occupying over 20 percent of the entire sample are used as examples, and their volumes calculated. These crystals were found to be much larger and more complex in shape than expected from thin-section examination alone. The surface-to-volume ration was calculated using a simple relationship between the length of lines in a grid crossing the crystal and grid-line intercepts with the crystal boundary. From this ratio the surface area of each crystal was calculated. A measurement of irregularity of jaggedness is introduced in order to compare crystals of different size with one another. This is necessary because surface-to-volume ratio of a body of the same shape decreases as the size increases. (Knapp-USGS)
W71-13839

DETERMINATION OF THE RATE OF SNOW ACCUMULATION AT THE POLE OF RELATIVE, INACESSIBILITY EASTERN ANTARCTICA: A COMPARISON OF GLACIOLOGICAL AND ISOTOPIC METHODS,
Ohio State Univ., Columbus. Inst. of Polar Studies.
E. Picciotto, and R. Cameron.
Journal of Glaciology, Vol 7, No 50, p 273-287, June 1968. 7 fig, 5 tab, 41 ref.

Descriptors: *Snowfall, *Antarctic, *Snowpacks, *Glaciers, Radioactivity techniques, Fallout, Regimen, Sampling, Stable isotopes, Radioisotopes.
Identifiers: Snow accumulation rate.

The rate of snow accumulation was measured at the U.S.S.R. station at the Pole of Relative Inaccessibility (eastern Antarctic plateau). Five independent methods were used. Results are expressed in g/cc/yr. Accumulation-stake measurements show an accumulation of 3.1 plus or minus 0.5 in 1965. A maximum value of 3.6 for the 6-year interval 1959-65 is derived from snow-thickness measurements. Firn stratigraphy was found difficult to interpret in terms of annual layers. An upper limit of

12 is suggested. 0-18/0-16 ratios were measured along the upper 235 cm. Assuming that each maximum in the isotope profile corresponds to a summer season, the accumulation would be 8.6 plus or minus 0.9. Gross beta radioactivity was measured as a function of depth on three firn sections. The 1955 radioactive fall-out horizon is clearly marked yielding an average accumulation of 3.0 plus or minus 0.1. The average accumulation over the last 80 years, derived from the Pb-210 distribution with depth, is 3.1 plus or minus 0.3. A multi-annual average accumulation rate of 3.0 plus or minus 0.3 is thus firmly established, as well as the validity of both the Pb-210 method and the 1955 radioactive fall-out horizon method. Stratigraphic studies lead to uncertain results. Oxygen isotope variations give accumulation values which are too high by a factor of two. Accumulation values of the same order of magnitude 2.8 plus or minus 0.2 were derived from radioactive fall-out measurements at the U.S. 'Plateau' station. (Knapp-USGS)
W71-13840

INSTRUMENTED PROBES FOR DEEP GLACIAL INVESTIGATIONS,
Cold Regions Research and Engineering Lab., Hanover, N.H.
H. W. C. Aamot.
Journal of Glaciology, Vol 7, No 50, p 321-328, June 1968. 4 fig, 9 ref.

Descriptors: *Instrumentation, *Ice, *Glaciers, *Telemetry, Sounding, Temperature, Surveys, Remote control, Research equipment, Cryology, Cold regions.
Identifiers: Glacier probes.

Instrumented probes are used to obtain information by remote measurement methods. The described thermal probes are nonrecoverable vehicles designed to carry instrumentation payloads into polar ice sheets to all depths. They sink into the ice by melt penetration with electrically heated hot points. They are surface controlled and powered through internally stored conductors which pay out of the advancing probes and become anchored in the refrozen melt water above. With suitable instrumentation they serve to measure properties and conditions deep in the ice. They also supplement deep core-drilling work by providing pertinent advance information. They can also place instruments or active devices into position for long-term observations and other functions. (Knapp-USGS)
W71-13841

INVESTIGATIONS OF PERENNIALLY FROZEN GROUND IN THE MONGOLIAN PEOPLE'S REPUBLIC (Issledovaniya mnogoletnemerzlykh gornykh porod v Mongol'skoy Narodnoy Respublike),
V. L. Sukhodrovskiy.
Akademiya Nauk SSSR Doklady, Vol 193, No 4, p 913-915, 1970. 4 ref.

Descriptors: *Frozen ground, *Permafrost, *Ice, *Cryogenics, *Cryology, Petrography, Thawing, Freezing, Seasonal, Frost action, Sediments, Topography, Climatic data.
Identifiers: *USSR, *Mongolia, Ice lenses, Ice distribution, Thermokarst, Cryoturbations.

A study of perennially frozen ground in Mongolia was conducted by a geocryologic party of the Joint Soviet-Mongolian Geological Expedition, which has been working in the Republic since 1967. The elevations at which perennially frozen ground can be found decrease from the southwest to the northeast. Directly below the zone of perennially frozen ground are relics of this layer which are separated from the layer undergoing seasonal freezing. The thickness of the seasonally thawed layer in the zone of perennially frozen ground ranges from 0.6 to 3.5 m and depends upon climatic conditions and on the type and wetness of the ground. The Lake Plateau north of the Bolnay Range is part of a continuous perennially frozen rock zone and is not isolated, as was previously assumed. At an elevation of 1,850 m the thickness of the perennially frozen ground on the Lake Plateau is as much as 140 m, which is the maximum authentic thickness of such ground recorded to date in Mongolia. Three horizons (complexes), differing in age and in type of their characteristic facies and ice-distribution patterns, were established in the perennially frozen lake sediments filling the Lake Plateau basin: (1) a 1- to 5-m thick horizon with a dense network of small ice lenses, formed during the migration of water (not under pressure) toward the frost front; (2) a 30- to 40-m thick horizon with ice lenses, formed during the migration of water (under pressure) toward the frost front; (3) a horizon with no visible ice inclusions at a depth of more than 40 m. The relief forms in Mongolia related to perennially frozen ground include (1) macropolygons and cracks; (2) hummocky blisters; (3) slope discontinuities; (4) mountain and solifluction terraces; (5) stone polygons and tracts; and (6) thermokarst formations. (Josefson-USGS)
W71-13864

TEXTURE OF ICE-CORED DEPOSITS FROM TEN ALASKAN VALLEY GLACIERS,
Memorial Univ. of Newfoundland, St John's. Dept. of Geology.
R. M. Slatt.
Journal of Sedimentary Petrology, Vol 41, No 3, p 828-834, September 1971. 3 fig, 1 tab, 26 ref. OWRR Project A-026-ALAS.

Descriptors: *Glacial drift, *Till, *Glaciers, *Alaska, Particle size, Particle shape, Provenance, Erosion, Scour, Mineralogy, Sampling, Sedimentology, Sediments, Geologic control, Bedrock, Structural geology.
Identifiers: Ice-cored glacial deposits.

Texture of twenty-six sediment samples from ice-cored deposits at the termini of ten Alaskan valley glaciers was determined. The glaciers are eroding five different types of bedrock. Results of pebble roundness and grain-size frequency distribution analyses reveal two groups of samples: (1) those with mean pebble roundness values in the subangular class and which do not exhibit distinct grain-size modes, and (2) those with mean pebble roundness values in the subrounded to rounded class and which exhibit either distinct modal grain-size classes or pronounced deficiencies in particles finer than coarse or medium sand. The characteristics of samples in the first group suggest these sediments are the product of glacial erosion of bedrock and frost action on valley walls. These processes produce particles of all sizes irrespective of bedrock type. The occurrence of modal proglacial sediment of valley glacier origin is therefore probably a function of the environment of transport and deposition and is independent of the nature of the bedrock type or initially eroded detritus. The characteristics of samples in the second group suggest they are primarily mixtures of former proglacial deposits. Prior to the most recent deposition, proglacial deposits were probably incorporated and mixed in the glacier load during ice advance. (Knapp-USGS)
W71-13928

2D. Evaporation and Transpiration

ANTITRANSPIRATION EFFECTS ON THE TRANSPIRATION AND PHYSIOLOGY OF TAMARISK,
Arizona Univ., Tuscon. Dept. of Watershed Management.
For primary bibliographic entry see Field 03B.
W71-13143

A NUMERICAL SOLUTION OF THE TWO DIMENSIONAL STEADY-STATE TURBULENT TRANSFER EQUATION,
Cornell Univ., Ithaca, N.Y. School of Civil Engineering.
Gour-Tsyh Yeh and Wilfried Brutsaert.
Monthly Weather Review, Vol 99, No 6, P 494-500, June 1971. 7 p, 7 fig, 7 tab, 9 ref. OWRR Project A-021-NY (2).

Descriptors: *Evaporation, *Diffusion, *Turbulent flow, *Mathematical models, *Mathematical studies, Numerical analysis, Mixing, Convection, Turbulence, Humidity, Density, Model studies, Winds, Temperature.
Identifiers: Turbulent diffusion.

In the finite-difference formulation of the two dimensional steady-state turbulent diffusion equation for solving evaporation problems, two difficulties arise caused by the automatic satisfaction of one of the boundary conditions at the surface and by the infinite size of the solution domain. A general numerical scheme is developed to overcome these difficulties by the use of appropriate transformations. The results of some numerical experiments show that the longitudinal diffusion term is usually negligible and that, with suitable parameters for roughness and stability, power laws can be as useful for practical solutions as the more complicated logarithmic law. (Knapp-USGS)
W71-13145

THERMAL STUDIES FOR HEATED WATER SYSTEMS,
Virginia Univ., Charlottesville. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 05C.
W71-13251

PROBLEMS ASSOCIATED WITH THE QUANTITATIVE STUDY OF LAKE BALANCE BY MEANS OF THE CONCENTRATIONS OF DEUTERIUM AND/SUP 18/0 IN THE WATER,
Commissariat A l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
For primary bibliographic entry see Field 02H.
W71-13387

ESTIMATING FREQUENCIES OF DAILY AMOUNTS OF GLOBAL RADIATION OVER AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research.
J. D. Kalma.
Australian Meteorological Magazine, Vol 18, No 3, p 134-145, September 1970. 6 fig, 1 tab, 14 ref.

Descriptors: *Solar radiation, *Climatic data, *Statistical methods, Arid lands, Humid regions, Mapping.
Identifiers: *Australia, *Actinographs, *Nomograms.

Frequencies of daily amounts of global radiation over Australia were estimated using a method developed in 1960 by Liu and Jordan in which the data is predicted reasonably accurately for a certain month from the ratio of mean daily global radiation at the surface to mean daily extra-terrestrial radiation. Between 1953 and 1968 a network of 7 Robitzsch bimetallic actinographs was in operation in Australia and regression equations were developed for estimating global radiation from cloudiness and sunshine observations based on this network. The appropriate radiation ratios were calculated with data from these stations and a nomogram is presented from which the statistical distribution of daily global radiation for each month at any Australian locality can be estimated. Predicted distributions at various stations not used in developing the nomogram were in good agreement with observations. (Casey-Arizona)
W71-13574

ANOMALIES IN THE LARGE-SCALE ANNUAL WATER BALANCE OVER NORTHERN NORTH AMERICA,
Toronto Univ. (Ontario); and Canterbury Coll., Windsor (Onario).
For primary bibliographic entry see Field 02B.

W71-13581

THE REGRESSION OF NET RADIATION UPON SOLAR RADIATION,
Oregon State Univ., Corvallis. School of Forestry.
Lloyd W. Gay.
Archiv fur Meteorologie, Geophysik und Bioklimatologie, Ser, B, Vol 19, No 1, p 1-14, 1971. 3 fig, 1 tab, 19 ref. Rockefeller Foundation Grant RF 61026, and Water Resources Research Institute of OSU, Project A-001-OREG.

Descriptors: *Solar radiation, *Infrared radiation, *Regression analysis, *Energy exchange, *Albedo, Evapotranspiration, Deserts, Forests, Irrigated land, Cotton, Surfaces, Model studies, Environmental effects, Estimating equations.
Identifiers: *Net radiation, *Longwave exchange coefficient.

If the relationship of net radiation to incoming solar radiation over natural surfaces could be adequately defined, evapotranspiration estimates would become possible in many areas where net radiation data is lacking. An empirical linear regression model has been developed in which net radiation is a function of global radiation, but it has been variously misinterpreted. The model is improved by removing the effect of the presence of the independent variable on both sides of the equation, regressing net radiation on absorbed solar radiation instead of incoming solar radiation and identifying net longwave flux as a function of solar radiation. These revisions remove the obscureness of regression errors because of the large size of incoming radiation relative to net longwave flux, incorporate albedo and derive a coefficient (lambda) which is the change in net longwave radiation over a surface per unit change in absorbed solar radiation and is termed the longwave exchange coefficient. Lambda is considered superior to beta, the surface heating coefficient. Possible measurement errors affecting the regression model are also considered. A radiometric error of only a few degrees may increase the error of the derivative of net longwave radiation with respect to incoming solar radiation by an order of magnitude. Lambda may serve as an index of the surface properties governing absorbed global radiation dissipation. This index is interpreted for 3 types of surfaces under cloudless skies: a desert, a forest and an irrigated cotton crop. The assumptions of the revised model are justified. (Casey-Arizona)
W71-13583

TRANSPIRATION IN THREE EUCALYPTUS SPECIES AS A FUNCTION OF SOLAR ENERGY, SOIL MOISTURE AND LEAF AREA,
Volcani Inst. of Agricultural Research, Rehovoth (Israel).
I. Gindel.
Physiologia Plantarum, Vol 24, No 1, p 143-149, 1971. 4 fig, 5 tab, 34 ref.

Descriptors: *Xerophytes, *Trees, *Soil moisture, *Solar radiation, *Evapotranspiration, Arid lands, Physiological ecology, Leaves, Soil-water-plant relationships, Evaporation, Albedo, Moisture stress, Temperature, Environmental effects, Mode of action, Laboratory tests, Loess, Field capacity, Thermal properties, Semi arid climates.
Identifiers: *Leaf area, *Xeromorphic adaptations, *Negev Desert.

In an effort to clarify the relationships between transpiration, physical evaporation, solar radiation and soil moisture in plants, 3 Australian Eucalyptus species that had been successfully acclimatized to arid and semi-arid regions of Israel, were grown in pots under identical physical and climatic conditions except for different soil moisture levels of 7% and 15.5% (field capacity). Subsequently, leaf area and relative transpiration rates were measured in differing climatic conditions. All 3 species, under water stress conditions showed 25-50% lower transpiration rates and 31.0 -42.8% smaller leaf areas. Despite the smaller mean leaf areas and exposure to the same solar radiation of the stressed group, when soil moisture was raised to field capacity, its transpiration rates increased to equal or exceed those of the group grown consistently at field capacity. It seems clear that the smaller xeromorphic leaves are capable of at least doubling transpiration rates independently of solar radiation if soil moisture is adequate. In woody xerophytes, therefore, transpiration rates seem dependent only on some interaction between soil moisture and inherent biological properties, and not the physical parameters of leaf area, solar radiation intensity or physical evaporation. A number of xerophytic adaptations are reviewed which support this conclusion. (Casey-Arizona)
W71-13589

LEAF TEMPERATURE EFFECTS ON MEASUREMENTS OF DIFFUSIVE RESISTANCE TO WATER VAPOR TRANSFER,
Stanford Univ., Calif. Dept. of Biological Sciences; and Australian National Univ. Canberra. Research School of Biological Sciences.
For primary bibliographic entry see Field 02I.
W71-13594

THE INFLUENCE OF THE ROOT SYSTEM ON THE RELATIONSHIP BETWEEN THE RATE OF TRANSPIRATION DEPRESSION OF LEAF POTENTIAL,
Aberdeen Univ. (Scotland). Dept. of Botany.
For primary bibliographic entry see Field 02I.
W71-13598

EVAPORATION AND TRANSPIRATION,
Hawaii Univ., Honolulu. Water Resources Research Center.
Paul C. Ekern.
Contribution No 27, Hawaii Water Resources Research Center, 1971, 6 p, 134 ref. Reprinted from EOS, Vol 52, No 6, June 1971. OWRR A-017-HI (1).

Descriptors: *Evaporation, *Transpiration, Lysimeters, Pan evaporation, Evapotranspiration, Evaporimeters, *Reviews.

This article is a portion of the U.S. National Report, 1967-1971 to the 15th General Assembly, IUGG, Part 3, Hydrology. Instrumentation research was directed toward more precise measurement of the components required for verification of the models of microscale exchange between the canopy and the air. The advent of satellites with broad scale measures of reflectance, and the renewed interest in the study of man's entire physical environment, which is epitomized in the term 'evapotranspiration climatonomy,' presaged an era of an increasingly physical-mathematical approach to evapotranspiration on a continental and even planetary level. A forcing function that is comprised of the product of the sorbed solar radiation and the precipitation (a response function of the soil moisture variations) with a simple parameterization of the 'evaporitivity' of the surface (fraction of radiation used in evaporation) gave a tentative model with improved prediction of the water budget of the central and eastern United States. Thus research proceeded at both extremes of the evapotranspiration process, from the individual plant root and stomatal pore to the entire planet Earth.
W71-13810

2E. Streamflow and Runoff

APPLICATIONS OF CLIMATOLOGY AND METEOROLOGY TO HYDROLOGIC SIMULATION,
Texas A and M University, College Station.
For primary bibliographic entry see Field 02B.
W71-13150

THE APPLICATION OF THE DSDT HYBRID COMPUTER METHOD TO WATER RESOURCES PROBLEMS,
California Univ., Los Angeles. School of Engineering and Applied Science.
For primary bibliographic entry see Field 06A.
W71-13151

SYNTHETIC STREAMFLOWS,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 02A.
W71-13289

HYDROGRAPHY OF SOUTH PASS, MISSISSIPPI RIVER,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
L. D. Wright.
ASCE Proceedings, Journal of the Waterways, Harbors and Coastal Engineering Division, Vol 97, No WW 3, Paper 8290, p 491-504, August 1971. 5 fig, 1 tab, 40 ref, append. NR 388 002, Geog. Programs, ONR. N00014-69-A-0211-0003.

Descriptors: *Bed load, *Sediment transport, *Tidal effects, *Mississippi River, *Deltas, Stratified flow, Saline water intrusion, Saline water-freshwater interfaces, Tides, Density stratification, Hydrography.
Identifiers: *South Pass (Mississippi River).

In the lower South Pass channel of the Mississippi Delta, a combination of salt-water intrusion and tide dominate circulation and mixing. Seaward discharge and vertical mixing in the channel are greatest during ebbing tide, when the hydrostatic gradient is at a maximum. Direction of flow within the salt-water wedge is largely a function of tidal phase, upstream currents prevailing during flooding tide, and downstream currents characterizing ebbing tide. Bed load transport in the lower channel, particularly at low and normal river stage, is, therefore, considered to be tide dependent. (Knapp-USGS)
W71-13443

COMMENTS ON SPATIAL RANDOMNESS IN DENDRITIC STREAM CHANNEL NETWORKS,
Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.
M. F. Dacey, and W. C. Krumbein.
NTIS, Springfield, Va. 22151 as AD-724 345; $3.00 printed copy. Office of Naval Research Geography Branch Technical Report No 17, April 1971, 31 p, 11 fig, 2 tab, 13 ref. Contract N00014-67-0356-0018.

Descriptors: *Streamflow, *Alluvial channels, *Channel morphology, *Dendritic, Spatial distributions, Reviews, Meanders, *Drainage patterns (Geologic).
Identifiers: *Stream networks, Topology of stream networks, Randomness.

Shreve's hypothesis of infinite topologically random channel networks is in essential agreement with observations of topological properties on many stream networks by numerous workers. Many basic attributes of stream networks are spatially dependent, such as locations of sources, distances between stream junctions, and angles of tributary entrance, that are not taken into account by analysis of topological propeties. In this paper, the needs for including spatial properties as well as topological properties of stream networks in terrain analysis are emphasized. The topological attributes are invariant under stretching or distortion of the space they occupy. Spatially dependent attributes of stream networks on the other hand, are seriously affected by stretching or distortion. These two kinds of network attributes are illustrated. (Woodard-USGS)
W71-13453

PREDICTION ERROR OF REGRESSION ESTIMATES OF STREAMFLOW CHARACTERISTICS AT UNGAGED SITES,
Geological Survey, Arlington, Va.
C. H. Hardison.
GPO, Washington, DC 20402 - Price $2.75. Geological Survey Research 1971, Chapter C, Professional Paper 750-C, p C228-C236, 1971. 3 fig, 5 tab, 7 ref.

Descriptors: *Statistical methods, *Streamflow forecasting, *Stream gages, *Rainfall-runoff relationships, Regression analysis, Hydrographs, Hydrograph analysis, Gaging stations, Data collections, Hydrologic data, Data processing, Estimating.
Identifiers: Stream flow estimating.

When the time-sampling error of a streamflow characteristic that is used in a multiple regression with basin characteristics is greater than the space-sampling error and when the average interstation correlation coefficient is less than 0.25 or greater than 0.75, the average standard error of prediction differs by more than 20 percent from the standard error of estimate of the regression. Graphs show how the relation between average prediction error and the regression error can be evaluated for any regression. A moderate increase in the length of record at the gaging stations used in the regression will seldom result in an appreciable decrease in the standard error of prediction. (Knapp-USGS)
W71-13454

FOREST SPECIES AS INDICATORS OF FLOODING IN THE LOWER WHITE RIVER VALLEY, ARKANSAS,
Geological Survey, Little Rock, Ark.
For primary bibliographic entry see Field 02I.
W71-13469

GEOMORPHOLOGY OF UPPER BASIN REACHES OF THE KOLYMA RIVER (Geomorfologiya basseyna verkhov'yev r. Kolymy),
Akademiya Nauk SSSR, Novosibirsk. Institut Geologii i Geofiziki.
For primary bibliographic entry see Field 02A.
W71-13502

DETERMINATION OF CHANNEL CAPACITY OF REACHES OF ASH AND BERENDA SLOUGHS AND A REACH OF THE CHOWCHILLA RIVER, MADERA COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
G. L. Bertoldi.
Geological Survey Open-file Report, 1971. 61 p, 2 fig, 3 tab, 8 ref, 11 append.

Descriptors: *Channel flow, *Channel morphology, *Streamflow, *Flow water, *Open channel flow, California design flow, Rivers, Floodwater, Runoff, Hydrologic data, Data collections, California.
Identifiers: *Channel capacity, Madera County (Calif.), *Chowchilla River (Calif).

The adequacy of reaches of Ash Slough, Berenda Slough, and the Chowchilla River to carry flood releases from the proposed Buchanan Reservoir in Madera County, California is evaluated. The two sloughs are distributaries of the Chowchilla River, downstream from the proposed reservoir. Computed water-surface profiles based on channel conditions in late 1969, indicate that the 9.2-mile reach of the Chowchilla River upstream from the two sloughs will carry 20,000 cfs within the natural banks. Floodflows of 6,000 cfs in Ash Slough downstream from cross section 40 and 10,000 cfs in the reach upstream will cause overbank flooding. Berenda Slough can carry floodflows of 2,000 cfs downstream from State Highway 152 and 4,000 cfs upstream from State Highway 152. These conclusions are contingent on there being no levee failures during periods of high flow. The various discharges will pass through bridge constrictions, but overbank flooding will result if debris should lodge against the Southern Pacific Co. railroad bridge over Ash or Berenda Sloughs. (Woodard-USGS).
W71-13504

CARRYOVER STORAGE REQUIREMENTS FOR RESERVOIR DESIGN IN MISSOURI.
Geological Survey, Rolla, Mo., Water Resources Div.
For primary bibliographic entry see Field 08A.
W71-13505

TSUNAMI-RESPONSES OF SAN PEDRO BAY AND SHELF, CALIFORNIA,
For primary bibliographic entry see Field 02L.
W71-13506

HYDROLOGIC RECONNAISSANCE OF GROUSE CREEK VALLEY, BOX ELDER COUNTY, UTAH,
Geological Survey, Salt Lake City, Utah.
J. W. Hood and D. Price.
Utah Department of Natural Resources Technical Publication No 29, 1970. 54 p, 8 fig, 2 plate, 14 tab, 60 ref, append.

Descriptors: *Water resources development, *Water supply, *Water quality, *Water yield, *Utah, Surface waters, Groundwater, Hydrologic data, Data collections, Precipitation (Atmospheric), Runoff, Aquifers, Water wells, Chemical analysis, Water level fluctuations, Hydrology, Surveys.
Identifiers: *Hydrologic reconnaissance, *Grouse Creek Valley (Utah).

Water resources data for Grouse Creek Valley in Box Elder County, Utah and part of Nevada are presented. Precipitation is estimated to average 276,000 acre-feet annually. All but about 1 percent of the precipitation ultimately is consumed within the drainage basin. The amount of groundwater available annually for salvage from nonbeneficial discharge is about 3,000 acre-feet. The water in Grouse Creek valley generally is of suitable chemical quality for domestic, stock, and irrigation use. The range in dissolved solids is 207-1,100 mg/liter. In most years, about 2,000 acres of land is irrigated from streams and springs and not all that land receives a full water supply. Wells have been used since 1948 to supplement other water supplies to a part of the irrigated land. Approximately 400 acres is irrigated from wells alone. The total annual supply of surface and groundwater in the valley is estimated to be 21,000 acre-feet, but the average annual amount that can be readily diverted is about 17,000 acre-feet. (Woodard-USGS)
W71-13509

WIND WAVE CHARACTERISTICS IN DEEP AND SHALLOW PARTS OF A BAY,
V. A. Ruthkovskiy.
Oceanology (USSR), Vol 11, No 1, p 28-35, 1971. 5 fig, 8 ref.

Descriptors: *Waves (Water), *Ocean waves, *Bays, Frequency, Shore protection, Statistical methods, Distribution patterns, Energy.

Measurements were made of wind wave elements and of the resulting pressure at subsurface depths in both the deep and shallow parts of a bay. The experimental distribution of wave heights and periods is compared with the generalized probability function. The transformation of the wind wave spectrum with depth and during wave propagation from deep to shallow areas is analyzed. The distribution of surface wave heights and periods agrees well with data obtained for the oceans and seas. Distribution functions recommended for surface waves cannot be applied directly to wave pressures. To use them it is either necessary to establish their limits of applicability with respect to depth or to modify the function itself. As the waves approach the shore, their heights and periods decrease, regardless of whether their approach is direct or oblique. Shallow water affects the transformation of the spectral composition of surface waves. This is manifested in the filtering out of the long-period spectral components in shallow water. (Knapp-USGS)
W71-13616

THE DETERMINATION OF SURFACE CURRENTS IN THE OCEAN,
Moscow State Univ. (USSR). Dept. of Geophysics; and Moscow State Univ. (USSR). Dept. of Oceanology.
G. V. Filimonov, and M. I. Freydlin.
Oceanology (USSR), Vol 11, No 1, p 109-112, 1971. 1 fig, 1 tab, 6 ref.

Descriptors: *Ocean currents, *Water temperature, *Distribution patterns, *Tracking techniques, Tracers, Data processing, Data collections, Current meters.

A method is proposed for determining ocean surface currents based on observations of the space-time variability of surface temperatures. The method is based on the study of the dynamics of temperature inhomogeneities, which act as 'tracers'. The relative simplicity with which the required initial data can be obtained permits charting the currents over large areas and studying their temporal variability. (Knapp-USGS)
W71-13621

THE PHYSICAL OCEANOGRAPHY OF THE NEW YORK BIGHT,
New York Univ., Bronx.
For primary bibliographic entry see Field 05B.
W71-13625

INTERRELATIONSHIP OF SURFACE AND SUBSURFACE FLOW IN THE NISHNABOTNA DRAINAGE BASIN,
Iowa State Univ., Ames; and Texaco, Inc., Ft. Wayne, Iowa.
For primary bibliographic entry see Field 02F.
W71-13655

MECHANICS OF SHEET FLOW UNDER SIMULATED RAINFALL,
Illinois Univ., Urbana. Dept. of Civil Engineering.
Yong Nam Yoon, and H. G. Wenzel, Jr.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY-9, Paper 8373, p 1367-1386, September 1971. 8 fig, 1 tab, 22 ref, append. OWRR B-018-ILL (4).

Descriptors: *Sheet flow, *Rainfall-runoff relationships, *Simulated rainfall, *Turbulence, Rainfall intensity, Time series analysis, Fourier analysis, Erosion, Roughness (Hydraulic), Overland flow, Hydraulic models.

Friction factors for spatially varied sheet flow with rainfall on a hydraulically smooth surface were obtained from both surface profile and hot film surface probe measurements. The results are presented in the form f — C/R, in which C increases with rainfall intensity and surface slope. A two part velocity profile mathematical model based on von Karman's similarity hypothesis is correlated with hot film measurements. Relative longitudinal turbulence intensity profiles with rainfall are characterized by a sharp increase in relative intensity near the surface and a general increase throughout the depth with increasing rainfall. Turbulent energy spectral analyses indicate that the rainfall causes a shift of the energy content to higher frequencies than for the case of uniform flow at the same Reynolds number. (Knapp-USGS)
W71-13798

TURBULENT STRUCTURE IN A TWO-DIMENSIONAL JET,
Wisconsin Univ., Madison. Water Resources Center.

For primary bibliographic entry see Field 08A.
W71-13804

COMPUTER PROGRAM FOR STATISTICAL ANALYSIS OF ANNUAL FLOOD DATA BY THE LOG-PEARSON TYPE III METHOD,
Minnesota Univ., St. Paul. Water Resources Research Center.
C. Edward Bowers, A. F. Pabst, and S. P. Larson.
Available from the National Technical Information Service as PB-203 422, $3.00 in paper copy, $0.95 in microfiche. Minnesota Water Resources Research Center, St. Paul, Bulletin 39, July 1971. 26 p, 16 fig, 4 ref. OWRR A-020-MINN (2).

Descriptors: *Floods, *Computer programs, *Statistical methods, Maximum probable flood, Minnesota.
Identifiers: *Log-Pearson Type III method, *Flood flow frequencies, *Fortran IV language, Recurrence interval, Mean annual flood, Gumble distribution, Log-normal distribution, Skewness coefficient, Standard deviation.

The Federal Water Resources Council has recommended the adoption of the log-Pearson Type III method of establishing flood flow frequencies. The computer program developed in this study was written in Fortran IV language to facilitate log-Pearson Type III method computations. Annual floods are sorted in decreasing magnitude and then logarithms, mean, standard deviation and skewness of the logarithms are computed. The magnitude of the 100, 50, etc., year flood are determined with the aid of tables. The initial computer printout consists of sorted values of the floods, empirical values of recurrence interval and probability, and the logarithms of the floods. Application of the method to selected streams in the United States indicates that difficulties may be encountered when a given set of data contains one or more very low floods or outliers. The log-Pearson Type III distribution appears to have a substantial advantage over the Gumble and log-normal distributions that have been used for flood frequency analysis because it can be used for data having either a plus or a minus skewness. Also, it reduces to the log-normal distribution for zero skewness where the data fit this distribution. However, it will require a data screening procedure and sufficient use to indicate desirable restrictions on skewness values for short records and perhaps for various regions. (Walton-Minnesota)
W71-13805

MODELING THE INFILTRATION COMPONENT OF THE RAINFALL-RUNOFF PROCESS,
Minnesota Univ., St. Paul. Water Resources Research Center.
For primary bibliographic entry see Field 02G.
W71-13806

WATER TEMPERATURES OF CALIFORNIA STREAMS, SAN FRANCISCO BAY SUBREGION,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 07C.
W71-13825

WATER-QUALITY AND QUANTITY DATA, EAST FORK KAWEAH RIVER BASIN, CALIFORNIA, 1969,
Geological Survey, Menlo Park, Calif.
W. W. Dean.
Geological Survey Open-file Report, June 3, 1971. 29 p, 5 fig, 8 tab, 2 ref.

Descriptors: *Streamflow, *Water quality, *Sediment transport, *Hydrologic data, *California, Data collections, Stream gages, Flow measurement, Runoff, Chemical analysis, Construction, Parks, Recreation facilities, River basin development.
Identifiers: *East Fork Kaweah River Basin (Calif).

Water-quality and quantity data are presented for the East Fork Kawaeh River basin in California for the 1969 water year (October 1, 1968 to September 30, 1969). The basin is a 95-square mile area in the southern Sierra Nevada ranging in altitude from 1,280 to 12,432 feet. Monitoring will be continued during construction of proposed resort facilities and access highways, and during subsequent operation of these facilities. The records obtained should permit detection of man-made changes and guide corrective action. Storms culminating on January 18, January 25, and February 24, 1969, brought heavy rains to the lower part of the East Fork Kaweah River basin and record-breaking snow at higher altitudes. A peak flow of 4,700 cfs occurred January 25, 1969, at the downstream recording station on East Fork Kaweah River near Three Rivers. Snowpack melting began at lower altitudes in late March and culminated with the greatest monthly runoff of record for the East Fork Kaweah River in May and June 1969. Concentrations of dissolved solids ranged from 19 to 141 mg/l. Hardness ranged from soft to moderately hard. Dissolved oxygen ranged from 7.6 to 13.6 mg/l. Most sediment concentrations were less than 25 mg/l, indicating that little sediment is produced under present conditions. (Woodard-USGS)
W71-13843

DRAINAGE AREA OF LOUISIANA STREAMS,
Geological Survey, Baton Rouge, La. Water Resources Div.
For primary bibliographic entry see Field 07C.
W71-13848

WATER-RESOURCES APPRAISAL OF ANTELOPE VALLEY AND EAST WALKER AREA, NEVADA AND CALIFORNIA,
Geological Survey, Carson City, Nev.
P. A. Glancy.
Nevada Division of Water Resources, Water Resources-Reconnaissance Series Report 53, 1971. 69 p, 6 fig, 1 plate, 2 photo, 20 tab, 28 ref.

Descriptors: *Water resources development, *Surface waters, *Groundwater, *California, *Nevada, Reviews, Water supply, Water yield, Water quality, Aquifer characteristics, Water users, Streamflow, Runoff, Water wells, Hydrogeology, Surface-groundwater relationships, Water balance.

Data concerning water resources in parts of Nevada and California are presented. The study area includes Antelope Valley, with particular respect to the Nevada part, along the West Walker River and that part of the East Walker River drainage between Bridgeport Reservoir and Mason Valley. About 985 square miles are included. The East and West Walker Rivers are the dominant hydrologic features of their respective areas or valleys. Water enters Antelope Valley by precipitation within the valley, as streamflow, and groundwater from upstream. It leaves by evaporation, transpiration, including both natural plants and crops, and by streamflow of the West Walker River. Small amounts are consumed by man and animals. Most crop irrigation in the East Walker area utilizes diverted streamflow, whereas both groundwater and surface-water irrigation occur in Antelope Valley. Groundwater, including springflow, furnishes most of the domestic and livestock water in both Antelope Valley and the East Walker area. Most surface and groundwaters in the area are of good chemical quality. Specific conductances of sampled waters range from 62 to 500 micromhos. (Woodard-USGS)
W71-13850

ATMOSPHERIC EFFECTS ON INFRARED MULTISPECTRAL SENSING OF SEA-SURFACE TEMPERATURE FROM SPACE,
Michigan Univ., Ann Arbor. Willow Run Labs.
For primary bibliographic entry see Field 07B.
W71-13851

WATER RESOURCES OF NORTH-CENTRAL OAHU, HAWAII,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W71-13855

UPPER RIFLE RIVER BASIN NORTHEASTERN LOWER MICHIGAN,
Geological Survey, Lansing, Mich.
R. L. Knutilla, F. R. Twenter, and R. W. Larson.
Geological Survey Water Information Series Report 1, 1971. 66 p, 64 fig, 8 tab, 20 ref.

Descriptors: *Water resources development, *Michigan, *Water supply, *Water quality, Surface waters, Groundwater, Hydrologic cycle, Streamflow, Runoff, Aquifer characteristics, Water yield, Hydrologic data, Flow rates, Watershed management.
Identifiers: *Upper Rifle River Basin (Mich).

The upper Rifle River Basin covers an area of 117 square miles in the northeastern part of Michigan's Lower Peninsula. Streamflow from the basin averages 140 cfs. Of this amount, about 103 cfs is derived from groundwater sources and 37 cfs from overland runoff. About 46 cfs reaches the basin from areas north and west of the basin's topographic divide. Groundwater supplies are obtained primarily from glacial deposits. More than 500 billion gallons of water are stored in these deposits. Much of this water is under artesian pressure--pressure often found to be adequate to supply household needs without the use of pumps. Bedrock deposits are of minor importance as a source for water supply. Most wells in bedrock yield highly mineralized water. In contrast, water from glacial deposits, as well as from lakes and streams, is of good chemical quality. (USGS)
W71-13859

PROBLEMS IN THE TRANSFORMATION OF RIVER SYSTEMS (Problemy preobrazovaniya rechnykh sistem),
For primary bibliographic entry see Field 04A.
W71-13862

TRIBUTARY INFLOW OF BIOGENOUS SUBSTANCES TO THE MOZHAYSK RESERVOIR (Stok biogennykh veshchestv po pritokam v Mozhayskoye vodokhranilishche),
Moscow State Univ. (USSR). Chair of Hydrology.
M. A. Khrustaleva.
Vestnik Moskovskogo Universiteta, Seriya 5, Geografiya, No 3, p 95-97, May-June 1971. 4 tab, 1 ref.

Descriptors: *Runoff, *Inflow, *Tributaries, *Reservoirs, Discharge (Water), Seasonal, Floods, Precipitation (Atmospheric), Nitrogen, Iron, Phosphorus.
Identifiers: *USSR, Moscow Oblast, Mozhaysk Reservoir, Moscow River, Lusyanka River, Koloch' River, Biogenous substances, Silicon.

The influx of mineral nitrogen, phosphorus, silicon, and iron to the Mozhaysk Reservoir (Moscow Oblast) was examined on the basis of their content in the Moscow, Lusyanka and Koloch' Rivers, which feed the reservoir. The total annual tributary inflow of these biogenous substances to the reservoir depends upon three factors: (1) the water discharge of the tributaries; (2) the amount of atmospheric precipitation; and (3) the concentration of these elements in the river waters. Seasonal variations in the total content of these elements entering the reservoir depend upon the volume of runoff of the tributaries. The maximum amount of biogenous substances in the tributary flow was observed during the period of spring floods; minimum concentrations occurred during all other seasons of the year. The amount of biogenous substances flowing into the reservoir in 1968 from all three tributaries was 8,620 metric tons and the amount discharged in the tail water channel of the hydroelectric power station was 3,934 metric tons. (Josefson-USGS)
W71-13867

FORECASTING THE RUNOFF OF THE YENISEY RIVER AT KYZYL FOR A SPRING-SUMMER PERIOD (Prognoz stoka r. Yenisey u g. Kyzyl za vesenne-letniy period),
Moscow State Univ. (USSR). Chair of Hydrology.
For primary bibliographic entry see Field 04A.
W71-13869

ENERGY LOSS ANALYSIS FOR OPEN CHANNEL EXPANSIONS,
Colorado State Univ., Fort Collins. Coll. of Engineering.
For primary bibliographic entry see Field 08B.
W71-13915

FLOW VISUALIZATION IN TURBULENT BOUNDARY LAYERS,
Hong Kong Univ. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 08B.
W71-13917

FLOODS OF DECEMBER 1964 AND JANUARY 1965 IN THE FAR WESTERN STATES, PART 2. STREAMFLOW AND SEDIMENT DATA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-13932

2F. Groundwater

SURVEY OF Sr87/Sr86 RATIOS IN STREAM AND GROUND WATERS OF OHIO,
Ohio State Univ., Columbus. Water Resources Center.
Paul Pushkar.
Available from the National Technical Information Service as PB-202 987, $3.00 in paper copy, $0.95 in microfiche. Project Completion Report No 367X, Ohio Water Resources Center, Ohio State University, Columbus, June 1971. 23 p, 6 ref, 4 tab, 3 fig. OWRR A-020-OHIO (1).

Descriptors: *Groundwater movement, *Tracers, *Water sources, Streams, Groundwater, Hydrogeology, Ohio, Analytical techniques, *Strontium radioisotopes.
Identifiers: Mass spectrometry, *Strontium isotope ratio, Sr87/Sr86 ratio, *Water origins.

A total of 19 Ohio stream and ground waters were sampled and analyzed for total Sr and Sr87/Sr86 isotopic ratios in an attempt to evaluate the potential usefulness of the Sr87/Sr86 ratio as a tracer of water origin. Samples were collected in order to provide a wide geographic distribution and a variety of contacted lithologies. The measured Sr87/Sr86 ratios range from about 0.708 to 0.713, with the higher ratios occurring in eastern Ohio and the lower ratios in the west. It is felt that this trend reflects the change in the dominant lithology of the Paleozoic sediments across Ohio. In the east clastic sediments predominate, whereas in the west limestone becomes a more important component of the sedimentary sequence. Most limestones of Paleozoic age or younger are known to have Sr87/Sr86 ratios of approximately 0.708, whereas shales have a wide range of higher values. Thus the Sr87/Sr86 ratios in western Ohio may reflect the greater proportion of limestone in the sedimentary column in this area. It is felt that the demonstrated variability of the Sr87/Sr86 ratio in Ohio waters, and its apparent dependence on lithology in the sampling areas, are sufficiently encouraging to warrant further study of the application of this parameter as a tracer in water studies.
W71-13169

SHALLOW SEISMIC REFRACTION MAPPING OF EOCENE WATER TABLES, NORTHERN MISSISSIPPI,
Mississippi State Univ., State College. Water Resources Research Inst.
Fred E. Followill.
Available from the National Technical Information Service as PB-202 988, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Mississippi State University, College, July 1971. 14 p, 2 fig, 1 tab, 3 ref. OWRR A-048-MISS (1).

Descriptors: *Perched water, *Groundwater, *Seismology, Mississippi, Sand, *Clays, *Velocity.
Identifiers: Lafayette County (Miss), *In situ velocities.

Seismic refraction measurements of sand and clay strata in the vicinity of the Wilcox-Claiborne (Eocene) contact in Northern Lafayette County, Mississippi, have been used as a basis of delineation of the areal extent of a perched water table. Insitu velocities of relatively pure sand or pure clay strata have similar velocities; however, insitu velocities increased with moisture or water content and decreasing sorting coefficient. Velocities decreased with porosity and weathering. The perched water table was capped with a low velocity zone, between the overlying clay stratum and the underlying saturated sands. Upper and lower bounds of the velocities in the unsaturated upper zone of the water bearing sand allowed calculation of the thickness of the low velocity layer, and the surface of the perched water table was mapped. The maximum hydraulic head of the Lambert Springs site was seventy feet during the wettest season of the year.
W71-13170

HYDROGEOLOGY OF THE USSR. VOLUME 16: THE WEST SIBERIAN PLAIN (Gidrogeologiya SSSR: Tom XVI: Zapadno-Sibirskaya ravnina),
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
V. A. Nudner.
Izdatel'stvo 'Nedra', Moscow, 1970. 368 p.

Descriptors: *Hydrogeology, *Engineering geology, *Geologic investigations, *Geology, *Groundwater, Aquifers Geologic formations, Structural geology, Topography, Orography, Hydrography, Permafrost, Water supply, Water chemistry, Mineral water, Thermal water, Natural resources, Irrigated land, Drainage, Climatic data.
Identifiers: *USSR, West Siberian Plain, Tyumen' Oblast, Omsk Oblast, Novosibirsk Oblast, Tomsk Oblast, Regionalization, Balneology, Mineralization.

This volume of the series 'Hydrogeology of the USSR' is devoted to a study of the hydrogeological and engineering-geological conditions of the Tyumen', Omsk, Novosibirsk and Tomsk Oblasts, which represent a large area of the West Siberian Plain and include the eastern slopes of the Polar Urals, and the northern part of the Sayan-Altay fold system. Particular attention is paid to the huge artesian basin, formed within the West Siberian Plain, where two hydrogeological levels (upper and lower) and five hydrogeological complexes are identified. The hydrogeological characteristics of the basin, including its oil and gas deposits and irrigated and drained lands, are examined from the standpoint of utilizing the vast groundwater resources of the area to satisfy the needs of the national economy. The division of the area into 10 engineering-geological regions is based on a study of (1) the geological structure, (2) the nature of the relief, and (3) the engineering-geological character of the rock formations. Other hydrogeological aspects examined include (1) the distribution of balneological resources (mineral waters, mineral and mud lakes); (2) the utilization of thermal waters in the national economy; and (3) the correlation of groundwater occurrence with the occurrence of natural resources. (Josefson-USGS)
W71-13302

HYDROGEOLOGY OF THE USSR, VOLUME 36: SOUTHERN KAZAKHSTAN (Gidrogeologiya SSSR. Tom XXXVI: Yuzhnyy Kazakhstan).
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
V. I. Dmitrovskiy.
Izdatel'stvo 'Nedra', Moscow, 1970. 472 p.

Descriptors: *Hydrogeology, *Engineering geology, *Structural geology, *Groundwater, Geomorphology, Hydrography, Groundwater recharge, Aquifers, Water chemistry, Thermal water, Mineral water, Connate water, Confined water, Mud, Irrigated land, Soils, Vegetation, Stratigraphy, Climatic data, Pollution abatement.
Identifiers: *USSR, *Kazakhstan, Alma-Ata Oblast, Dzhambul Oblast, Chimkent Oblast, Kzyl-Orda Oblast, Tectonics, Regionalization, Mineralization, Artesian basins.

This volume in the series 'Hydrogeology of the USSR' examines the hydrogeological and engineering-geological conditions in the vast and geologically complex area of Southern Kazakhstan, which includes the Alma-Ata, Dzhambul, Chimkent and Kzyl-Orda Oblasts covering an area of 755,000 sq km. The hydrogeological division of the area into 11 regions, which are basin systems of interstitial and artesian waters, is based on the structural features that best describe the formation and distribution of groundwaters. The engineering-geological division of Southern Kazakhstan into 11 regions is based on the structural-tetonic features of the area. The engineering-geological regions identified are: (1) the Turgayskiy depression; (2) the Severo-Kyzylkum syneclise; (3) the Chu depression; (4) the Karatau anticlinorium; (5) the Talasskiy and Ugamskiy anticlinoria; (6) the Ketmen' and Trans-Ili anticlinoria; (7) the Chu-Ili anticlinorium; (8) the Ili depression; (9) the Dzhungarskiy anticlinorium; (10) the Alakul'-Balkhash depression; and (11) the Severo-Balkhash synclinorium. Other aspects of the hydrogeology of the area examined include (1) the hydrogeological conditions of mineral deposits; (2) the hydrogeological conditions of irrigated lands; (3) the importance of thermal waters to heat and power supplies; (4) the distribution of mineral waters and medicinal muds; and (5) the abatement or prevention of groundwater contamination and depletion. (Josefson-USGS)
W71-13303

DISTRIBUTION OF BROMINE AND IODINE IN GROUNDWATER OF THE SOUTHERN TIMANS (Raspredeleniye broma i ioda v podzemnykh vodakh Yuzhnogo Timana),
Akademiya Nauk SSR, Syktyvkar, Institut Geologii.
V. Ya. Krivosheyev.
Akademiya Nauk SSSR Doklady, Vol 193, no 2, p 441-444, 1970. 4 fig, 2 tab, 2 ref.

Descriptors: *Geochemistry, *Groundwater, Hydrogeology, Water analysis, Water quality, Salinity, Calcium, Aquifers.
Identifiers: *USSR, *Bromine, *Iodine, Komi ASSR, Timans, Pechora Basin, Water exchange, Mineralization.

Bromine and iodine are fairly widespread in groundwater of the southern Timans and the southern part of the Pechora Basin (Komi ASSR). In many places the bromine concentration is high enough to be commercially valuable. The bromine content depends upon the following factors: (1) chemical composition of water; (2) salinity of groundwater; (3) calcium content; (4) degree of alteration of water; (5) depth of groundwater; and (6) intensity of water exchange. The iodine content in groundwater of aquifers of the southern part of the Pechora artesian basin is very low and in most cases does not exceed 5 to 7 mg/liter. The relationship between the iodine content of groundwater and its composition, salinity and depth appears to be very weak. The distribution of iodine in groundwater of the region is very nonuniform owing to the hydrogeologic complexity of the southern Timans (presence of faults and flexures, multiplicity of structures and other factors). (Josefson-USGS)
W71-13307

A DEVICE FOR MEASURING DOWN-HOLE PRESSURES AND FOR SAMPLING FLUIDS IN GEOTHERMAL WELLS,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 07B.
W71-13457

A DEVICE FOR COLLECTING DOWN-HOLE WATER AND GAS SAMPLES IN GEOTHERMAL WELLS,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 07B.
W71-13458

CARBONATE EQUILIBRIA DISTRIBUTION AND ITS RELATION TO AN AREA OF HIGH GROUND-WATER YIELD IN NORTHWEST OHIO,
Geological Survey, Columbus, Ohio.
For primary bibliographic entry see Field 02K.
W71-13462

A METHOD FOR ESTIMATING EFFECTIVE POROSITY IN A RUBBLE CHIMNEY FORMED BY AN UNDERGROUND NUCLEAR EXPLOSION,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 07B.
W71-13463

GEOLOGY AND GROUND-WATER RESOURCES OF GRANBY, MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
W. F. Althoff.
Massachusetts University Water Resources Research Center Report, 1970. 170 p, 18 fig, 7 plate, 4 tab, 53 ref, 7 append. OWRR B-011-MASS (5).

Descriptors: *Hydrogeology, *Aquifers, *Water quality, *Massachusetts, *Water yield, Glacial drift, Urbanization, Fractures (Geology), Groundwater basins, Aquifer characteristics, Data collections, Hydrologic data, Water pollution sources.
Identifiers: *Granby (Mass).

Basic hydrogeological information is compiled for the bedrock and surficial aquifers underlying the Granby, Mass., area. Hydrogeological studies include bedrock topography, thickness of the overlying surficial blanket, surficial (glacial) deposits, and the general pattern of groundwater movement. A generalized soils map, showing correlation with the underlying geology, identifies favorable areas for septic tank systems. Partial chemical analyses define the chemical character of water in the heavily-developed bedrock aquifer and in the relatively undeveloped, but potentially productive, surficial aquifers. Sanitary analyses of groundwater for coliform bacteria, chlorides, and the combined forms of nitrogen demonstrate the effects of municipal growth. The metamorphic bedrock aquifers yield about 10 gpm from joints and other fractures. Triassic sedimentary rocks furnish larger supplies, ranging from 2 to 40 gpm and averaging 12 gpm. The stratified drift deposits are capable of yielding moderate supplies. Some delta deposits may also supply moderate yields. Wastewaters discharged from domestic septic tank sewage systems pollute waters in both bedrock and unconsolidated aquifers. Till deposits have low permeability, and therefore generally are unfavorable for septic tanks. Pumpage of groundwater is wholly for domestic purposes and averaged about 0.25 million gallons per day in 1969. The estimated average annual use of groundwater in the area is only about 2% of the total recharge. (Knapp-USGS)
W71-13480

THE MAIN GENETIC TYPES OF THE EARTH'S CRUST MINERAL WATERS AND THEIR DISTRIBUTION IN THE U.S.S.R.,
V. V. Ivanov, L. N. Barabanov, and G. N. Plotnikova.
Proceedings of Symposium II on Genesis of Mineral and Thermal waters, Vol 17, Report of 23rd Session of International Geological Congress, 1968, Academia Prague, p 33-39, 1968. 1 tab.

Descriptors: *Mineral water, *Hydrogeology, *Subsurface waters, *Magmatic water, *Meteoric water, Water vapor, Gases, Hydrologic cycle, Water properties, Thermal water, Sedimentary rocks, Basalts, Crystalline rocks, Lava, Pumice, Metamorphic rocks, Igneous rocks, Faults (Geology), Land subsidence, Seismology, Earthquakes, Quaternary period, Recent epoch.

Mineral waters of various chemical composition and origin constitute the underground hydrosphere. Mineral waters in the upper three layers of the earth's crust are discussed. These areas are differentiated into: (A) Areas free of recent magmatic processes; (B) Areas of young abyssal magmatic and thermometamorphic phenomena; and (C) Areas of contemporary active volcanism. Within these three areas definite genetic types of mineral waters with different composition are formed. Some types cannot be formed under natural conditions. (Glasby-USGS).
W71-13481

THE COMMON FEATURES OF THE GENESIS OF MINERAL WATERS IN THE NW PART OF THE BOHEMIAN MASSIF,
G. Kacura.
Proceedings of Symposium II on Genesis of Mineral and Thermal waters, Vol 17, Report of 23rd Session of International Geological Congress, 1968, Academia Prague, p 41-44, 1968. 1 fig, 5 ref.

Descriptors: *Hydrogeology, *Geohydrologic units, *Thermal springs, *Mineral waters, *Percolating water, *Subsurface waters, Confined water, Hot springs, Granites, Crystalline rocks, Sedimentary rocks, Metamorphic rocks, Rock properties, Coal mines, Strip mines, Strip mine wastes, Soil conservation, Water conservation, Soil erosion, Sediments, Mud, Loam, Marl.

Genetic features related to thermal mineral springs originating in the granite basement of the northwestern Bohemian Massif are discussed. Overlying basin sediments from which these springs issue consist of impermeable loams and marls that form a confining stratum over the principle aquifers. Hydrogeological conditions were studied to determine what protective measures could be employed to protect the piezometric surface from the danger of future coal mining operations. (Glasby-USGS)
W71-13482

GENESIS OF MINERAL WATERS IN THE TIBERIAS-DEAD SEA-ARAVA RIFT VALLEY, ISRAEL,
E. Mazor.
Proceedings of Symposium II on Genesis of Mineral and Thermal waters, Vol 17, Report of 23rd Session of International Geological Congress, 1968, Academia Prague, p 65-80, 1968. 6 fig, 1 tab.

Descriptors: *Mineral water, *Water types, *Water properties, *Sea water, Water quality, Chemical analysis, Hydrologic data, Data collections, Water chemistry, Reviews.
Identifiers: *Dead Sea, *Syrian-African Rift Valley, *Tiberias-Noit waters.

The genesis of over 170 mineral water sources from the 200 km long Israeli section of the Syrian-African Rift Valley were studied. Most of these sources are similar in their salt composition and belong to the 'Tiberias-Noit water association'. The salt concentration varies from oceanic to fresh water. Probably the Mediterrancan Sea invaded the Rift Valley and huge amounts of ocean water infiltrated into the tectonically shattered valley. After the disconnection of the sea these waters remained in traps with initial ocean salt composition and concentration. The waters underwent slight exchange and dissolution processes that caused local deviations from ocean composition. Similar processes took place at the present Coastal plain. The mineral waters mix with local fresh water, forming the Tiberias-Noit water association. In a few places on the Dead Sea shore these initially oceanic waters mix with infiltrating Dead Sea brines to form the saline Zohar-Yesha waters. At Mt. Sedom the ascending Tiberias-Noit waters dissolve various salts to form the very highly saline Mt. Sedom mineral seepages. (Woodard-USGS).
W71-13483

GEOCHEMICAL HYDRODYNAMICS - A POSSIBLE KEY TO THE HYDROLOGY OF CERTAIN AQUIFER SYSTEMS IN THE NORTHERN PART OF THE GULF OF MEXICO BASIN,
Geological Survey, Baton Rouge, La.
P. H. Jones.
Proceedings of Symposium II on Genesis of Mineral and Thermal Waters, Vol 17, Report of 23rd Session of International Geological Congress, 1968, Academia Prague, p 113-125, 1968. 6 fig, 2 tab, 17 ref.

Descriptors: *Hydrogeology, *Gulf of Mexico, *Groundwater, *Aquifer characteristics, *Geochemistry, Water quality, Water types, Water yield, Water temperature, Hydrodynamics, Water chemistry, Water analysis, Chemical analyses.
Identifiers: *Artesian aquifers, *Gulf of Mexico basin.

The hydrology of artesian aquifer systems in the northern Gulf of Mexico basin, which yield more than 2 billion gallons a day of fresh water to wells, can be resolved by applying the principles of both gravity hydrodynamics and geochemical hydrodynamics. Effective management of the groundwater resources must include not only the conventional methods and procedures for withdrawal, but also the innovations that include: extraction of fresh water from clay-shale deposits by well fields designed for that particular purpose; development of flowing artesian wells to yield superheated fresh water from the down-dip extensions of geopressured zones; development of both fresh water and thermal power from self-distillation of superheated brines, which occur throughout the province below a depth of about 4,000 meters; and disposal of brine concentrates from any self-distillation systems into aquifer zones selected for osmotic pumping, to redistribute fresh or less saline water in adjacent aquifer systems, to control or prevent salt-water encroachment, or to raise reservoir pressures for production of fluid hydrocarbons. (Woodard-USGS)
W71-13484

THE PROBLEM OF ORIGIN OF HIGH TEMPERATURE SPRINGS OF INDIA,
Geological Survey of India, Calcutta.
For primary bibliographic entry see Field 02K.
W71-13485

BACTERIAL ORIGIN OF SULFURIC ACID IN SULFUROUS HOT SPRINGS,
R. Schoen, and G. C. Ehrlich.
Proceedings of Symposium II on Genesis of Mineral and Thermal Waters, Vol 17, Report of 23rd Session of International Geological Congress, 1968, Academia Prague, p 171-178, 1968. 2 fig, 1 tab, 10 ref.

Descriptors: *Thermal springs, *Sulfur bacteria, *Hot springs, Bacteria, Water chemistry, Hydrogeology, Water temperature, Soil temperature, Chemical reactions, Sulfur, Oxidation.
Identifiers: *Thiobacillus thiooxidans.

The sulfur-oxidizing bacterium Thiobacillus thiooxidans is found in abundance in many sulfurous hot-spring areas in the western United States. T. thiooxidans occurs only in samples taken from depths less than 18 cm and at temperatures

less than 50 degrees C. Hot-spring areas in which hydrogen sulfide, carbon dioxide water are constantly supplied and the ground temperature is uniformly warm throughout the year, are ideal places for the prolific growth of T. thiooxidans. The quantity of sulfuric acid that T. thiooxidans can produce in its life processes appears to be adequate to account for the sulfuric acid observed in most acid thermal springs. Although an inorganic mechanism may exist for the natural oxidation of hydrogen sulfide and elemental sulfur to sulfuric acid, its rate is probably so much slower than exhibited by T. thiooxidans as to be quantitatively insignificant. (Woodard-USGS)
W71-13486

ORIGIN OF CO2 IN THE SALTON SEA GEOTHERMAL SYSTEM, SOUTHEASTERN CALIFORNIA, U.S.A.,
L. J. P. Muffler, and D. E. White.
Proceedings of Symposium II on Genesis of Mineral and Thermal waters, Vol 17, Report of 23rd Session of International Geological Congress, 1968, Academia Prague, p 185-194, 1968. 2 fig, 1 tab, 16 ref.

Descriptors: *Thermal springs, *California, *Mineral water, *Carbon dioxide, *Hydrogeology, Geology, Hot springs, Water temperature, Mining, Water chemistry, Chemical analysis, Water quality.
Identifiers: *Geothermal system, *Salton Sea (Calif).

The Imperial Carbon Dioxide Gas Field in California produced in excess of 18,400,000 cubic meters of carbon dioxide gas between 1934 and 1954. The carbon dioxide field is part of the Salton Sea geothermal system, from which a concentrated brine rich in Cl, Na, Ca, K, Fe and other elements from depths of 900 to 1,600 meters produced at temperatures up to 360 degrees C. The geothermal system is entirely within upper Cenozoic sandstone, siltstone, and claystone of the Colorado River delta. These sedimentary rocks were originally composed of quartz, feldspars, clays, and approximately 8 percent calcite and 4 percent dolomite. Five small rhyolite domes of late Pleistocene or Recent age are present in the area of the geothermal system. Examination of drill-hole cuttings indicates that original carbonates are destroyed and carbon dioxide liberated in two hydrothermal metamorphic reactions that affect the sediments at depth in the high temperature environment of the geothermal system. The carbon dioxide liberated from the sediments migrates upward and laterally to the shallow carbon dioxide reservoirs. The quantity of carbon dioxide liberated in the metamorphism is at least five orders of magnitude greater than the recorded production of carbon dioxide from the field. (Woodard-USGS).
W71-13487

MERCURY-ANTIMONY-ARSENIC MINERALIZATION OF RECENT THERMAL SPRINGS OF KAMCHATKA AND THE KURILE ISLANDS (Rtutno-sur'myano-mysh'yakovaya mineralizatsiya sovremennykh gidroterm Kamchatki i Kuril'skikh ostrovov),
Institut Vulkanologii, Petropavlovsk-Kamchatskii (USSR).
N. A. Ozerova, S. I. Naboko, and V. I. Vinogradov.
Akademiya Nauk SSSR, Sibirskoye Otdeleniye, Geologiya i Geofizika, No 1, p 3-9, January 1971. 1 tab, 10 ref.

Descriptors: *Thermal springs, *Thermal water, *Groundwater, *Water quality, *Sulfur compounds, Volcanoes, Mineralogy, Sulfur, Sulfides, Sulfates, Pyrite, Hydrogen sulfide, Magmatic water, Sodium chloride.
Identifiers: *USSR, *Mercury, *Antimony, *Arsenic, Kamchatka, Kurile Islands, Mineralization, Volcanism.

Mercury, antimony and arsenic sulfide deposits in the Kuriles-Kamchatka volcanic region and the metal-bearing thermal springs forming these sulfides were examined to study the recent hydrothermal formation of ores. Data obtained from an isotopic analysis of sulfides and sulfates in the sulfur thermal waters were used to explain the genesis of hydrothermal solutions in the active volcanic regions and to determine the influence of endogenic emanations and the interaction of groundwater and country rocks. The isotopic composition of sulfates in the Apapel'skiye and Dvukhyurtochnyye springs of Kamchatka is typical of groundwaters formed in crystalline rocks. The springs resemble, by their chemical and sulfur isotopic composition, the typical' nitrogen thermal springs' found in many regions of the world. The complex character of volcanogenic thermal water formation is particularly evident on Kunashir Island of the Kuriles. Mineralized sodium-chloride thermal waters emerge from the foothills of the Mendeleyev volcano in a band extending several hundred meters along the shore line of the Goryachiy Plyazh. The mineralization of these waters in deep boreholes reaches 26 g/liter and corresponds to the composition of ocean water. The isotopic composition of sulfates in the acidic sulfate thermal springs of the Mendeleyev volcano ranges from plus 11.6 to plus 18%. The isotopic composition of sulfides in the crater of the Uzon volcano on Kamchatka is near zero. The sulfates, which are similar to sulfides in their isotopic composition, are for the most part associated with the oxidation of hydrogen sulfide. The thermal waters of the volcano are, by the geologic conditions of their emergence, similar to typical magmatic waters. (Josefson-USGS)
W71-13494

FORMATION OF THE CHEMICAL COMPOSITION OF GROUNDWATERS IN THE CISCAUCASIAN AND CISCARPATHIAN DEPRESSIONS (Oformirovanii khimicheskogo sostava podzemnykh vod Predkavkazskogo i Predkarpatskogo progibov),
Moscow State Univ. (USSR).
K. Ye. Pit'yeva, S. A. Kovalevskaya, and M. M. Chekovskikh.
Sovetskaya Geologiya, No 6, p 74-88, June 1971. 4 fig, 7 tab, 12 ref.

Descriptors: *Groundwater, *Rocks, *Water types, *Water quality, *Salinity, Water chemistry, Hydrogeology, Aquifers, Bicarbonates, Sodium chloride, Magnesium, Calcium chlorode, Sulfates, Anhydrite, Halogens, Ions, Cation exchange.
Identifiers: *USSR, Ciscaucasia, Ciscarpathia, Mineralization, Magnesium chloride, Magnesium sulfate, Halites.

The formation conditions of relatively deep saline groundwaters of the Ciscaucasian and Ciscarpathian depressions were examined in connection with classifying the chemical composition of groundwaters by the degree and type of their mineralization. The chemical composition of groundwaters is the result of physico-chemical processes, dictated by the mineral properties of rocks in contact with groundwater and by the properties of the hydrochemical media, which determine the effectiveness of the action of rocks on water and on the migration capacity of elements. Groundwaters in the piedmont depressions under study were divided into 4 genetic groups: (1) bicarbonate groundwaters with a mineralization of 1-30 g/liter; (2) sodium chloride groundwaters with a mineralization of 20-200 g/liter or more; (3) magnesium chloride and calcium chloride groundwaters with a mineralization of 40-300 g/liter or more; and (4) sulfate groundwaters of sulfate (gypsum and anhydrite) rocks, sodium chloride waters of halites, and magnesium chloride and magnesium sulfate waters of halogenic carnallite-enriched formations with a mineralization of 6-400 g/liter. Considerable changes were observed in the chemical composition of the groundwaters and rocks during their interaction under static and dynamic conditions. Quantitative changes in solution of rock systems may lead to identification of groundwaters of varying quality. (Josefson-USGS)
W71-13495

FORECASTS OF EXTREMAL WATER INFLOWS TO MINE WORKINGS AND GROUNDWATER INTAKES BY MEANS OF STATISTICS AND PROBABILITY METHODS (Prognozy ekstremal'nykh pritokov vody k gornym vyrabotkam i vodozaboram podzemnykh vod s primeniyem veroyatnostno-statisticheskogo metoda),
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
V. D. Babushkin, and L. Z. Levi.
Sovetskaya Geologiya, No 6, p 97-105, June 1971. 1 fig, 2 tab, 13 ref.

Descriptors: *Hydrogeology, *Groundwater, *Statistical methods, *Probability, *Inflow, Forecasting, Mine drainage, Intake structures, Groundwater recharge, Intakes, Groundwater movement, Aquifers, Storage, Water levels, Precipitation (Atmospheric).
Identifiers: *USSR, Extreme-value theory, Hydrographic network.

The formation of water inflows to mine workings and groundwater intakes is examined as a nonstationary probability process, which can be readily analyzed provided the trend and the random deviations from it are removed from the set of observations. Methods for calculating the trend and random deviations under various natural conditions are based on the operational characteristics of water-intake structures. The use of statistics and probability to forecast extremal water inflows to groundwater intakes and mine workings must be based on a detailed study of the hydrogeological conditions of the region. Application of these methods makes it possible (1) to forecast extremal water inflows and levels under extremely complex hydrogeological conditions, for which no other suitable methods of computation exist; (2) to express water inflow and level forecasts in terms of probability; and (3) to take into account the influence of seasonal and perennial fluctuations in the groundwater recharge of aquifers. (Josefson-USGS)
W71-13496

STRONTIUM IN GROUNDWATER OF THE PRIPYAT OIL-AND GAS-BEARING BASIN (Strontsiy v plastovykh vodakh Pripyatskogo neftegazonosnogo basseyna),
Akademiya Navuk BSSR, Minsk. Laboratoriya Geokhimicheskikh Problem.
G. V. Bogomolov, M. F. Kozlov, and A. V. Kudel'skiy.
Geokhimiya, No 6, p 719-724, June 1971. 4 fig, 2 tab, 11 ref.

Descriptors: *Geochemistry, *Groundwater, *Water quality, Connate water, Calcium, Calcium chloride, Sodium chloride, Salts, Halogens, Sea water, Natural resources, Distribution patterns.
Identifiers: *USSR, *Pripyat Basin, *Strontium, Mineralization, Evaporites.

The strontium content in groundwater of the Pripyat Basin was examined to determine its distribution patterns and to develop rational methods of prospecting and exploiting mineral resources. The concentration of strontium in the groundwater is directly dependent upon the calcium content and varies between 11.4 and 4,150.7 mg/liter. Maximum strontium concentrations (907-4,150.7 mg/liter) are found in the Yel'skaya, Oktyabr'skaya, Severo-Domanovichskaya, Shestovichskaya, Vishanskaya, Davydovskaya, Ostashkovichskaya, Anisimovskaya, and Kustovnitskaya regions and are associated with highly mineralized (320.9-416 g/liter) calcium chloride and sodium chloride waters of Devonian deposits. Smaller amounts of strontium (870-907 mg/liter) are found in sodium chloride waters having a mineralization of 20-327 g/liter. Groundwaters of high strontium content are confined to the deepest parts of the basin depressions. Calcareous-clay and halogenic deposits are the principal source of strontium in the calcium chloride and sodium chloride waters of the region. The close relationship between strontium and calcium makes it possible to use the geochemical data on strontium for studying the formation of calcium chloride waters. (Josefson-USGS)

W71-13497

POSSIBLE USE OF MAGNETIC FIELDS IN DETERMINING PORE GEOMETRY OF POROUS MEDIA,
Bureau of Mines, Morgantown, W.Va.
C. I. Pierce, L. C. Headley, and W. K. Sawyer.
Society of Petroleum Engineers Journal, Vol 11, No 3, p 223-228, September 1971. 10 fig, 8 ref.

Descriptors: *Porous media, *Pores, *Flow, *Permeameters, *Magnetic studies, Porosity, Permeability, Instrumentation, Aquifer characteristics.
Identifiers: *Pore geometry, *Magnetohydrodynamics.

Simplified models, consisting of single, circular channels and channels of different length and diameter in series and parallel combinations, were used in conjunction with the equations of Poiseuille and Hartmann to demonstrate the dependence of the rate of flow of mercury in the models on channel dimensions when the models are subjected to transverse magnetic fields. Tests using mercury-saturated, glass-bead packs and a natural rock sample show that a magnetic field applied transversely to the direction of flow retards flow rate. The magnitude of the magnetic effect increased with increasing bead size and field intensity. These results suggest that magnetic fields have potential in the study of the internal geometry of flow channels in porous media. (Knapp-USGS)
W71-13613

PERMEABILITY CONSIDERATIONS IN GENERATION OF ABNORMAL PRESSURES,
Imperial Oil Ltd., Calgary (Alberta).
Kinji Magara.
Society of Petroleum Engineers Journal, Vol 11, No 3, p 236-242, September 1971. 9 fig, 11 ref.

Descriptors: *Pressure, *Confined water, *Shales, *Compaction, *Permeability, Sedimentation, Aquifers, Aquicludes, Loads (Forces), Osmosis, Rock mechanics, Connate water, Subsidence.
Identifiers: *Abnormal fluid pressure.

Abnormal fluid pressures in shale-sandstone sequences commonly occur in the relatively deeper parts of the sequences. The causes of these anomalous pressures may be explained by the shale permeability and the fluid-expulsion mechanisms related to compaction. The volume of fluids that should be expelled from shales in unit time for the compaction equilibrium (or the hydrostatic pressure) condition to be maintained would increase with increases both in the rate of sedimentation and in the total thickness of the sequence. The minimum permeability necessary for maintenance of the hydrostatic pressure condition would, therefore, increase with increases in the sedimentation rate and the total thickness. When the actual permeability in the subsurface is less than this estimated minimum permeability for the equilibrium condition, some fluids will remain in the shales. In such a case, the compaction equilibrium condition cannot be attained and abnormal pressures will result. Results obtained from an analysis of data on the Gulf Coast area tend to support this theory. (Knapp-USGS)
W71-13614

INTERRELATIONSHIP OF SURFACE AND SUBSURFACE FLOW IN THE NISHNABOTNA DRAINAGE BASIN,
Iowa State Univ., Ames; and Texaco, Inc., Ft. Wayne, Iowa.
Lyle V. A. Sendlein, Keith M. Hussey, and Randolph Stone.
Available from the National Technical Information Service as PB-203 349, $3.00 in paper copy, $0.95 in microfiche. Iowa State Water Resources Research Institute, Ames, Completion Report ISW-RRI-34, June, 1971. 179 p, 34 fig, 20 tab, 42 ref, 7 append. OWRR A-030-IA (1).

Descriptors: *Groundwater movement, Groundwater, *Flow, Iowa, Aquifer, *Drawdown, Streamflow, Sand, Gravel, *Influent streams, Low flow.
Identifiers: Bedrock valley, Pro-glacial sand and gravel, *Groundwater exploration, Influent river water, *Nishnabotna River basin, Fremont Channel (Iowa).

The Nishnabotna River Basin is situated in a glacial terrain underlain by a bedrock valley system that contains important volumes of pro-glacial sand and gravel. Study of low-flow river discharge, patterns of spatial variation of groundwater hydraulic head potential, surface and groundwater quality relations, and subsurface geology indicate that topography controls the pattern of groundwater flow near the Basin divide but that groundwater flow patterns within the Basin respond to both surface topography and the subsurface geology. Exportation of groundwater from the Basin at locations other than the surface outlet is limited to flow of about 500,00 gpd through the pro-glacial aquifer of a tributary bedrock valley. The major bedrock valley, the Fremont Channel, exerts strong potential drawdown effects within the Basin. Where this bedrock valley horizontally coincides with the West Nishnabotna valley, the drawdown effects of the two are superimposed, and a balance between stream flow and groundwater flow is maintained with groundwater discharge to the river. At the locations of horizontal divergence from the West Nishnabotna valley and horizontal convergence with it, the Fremont Channel exerts dominating potential drawdown with resulting flow of influent river water to it. River low-flow data yield small and negative reach incremental discharges at these locations.
W71-13655

METHANE GAS IN WATER WELLS,
Bates Coll., Lewiston, Me. Dept. of Geology and Biology.
For primary bibliographic entry see Field 04B.
W71-13717

STEADY STATE WELL FLOW THEORY FOR A CONFINED ELLIPTICAL AQUIFER,
Iowa State Univ., Ames. Dept. of Agronomy.
R. R. Van der Ploeg, D. Kirkham, and C. W. Boast.
Water Resources Research, Vol 7, No 4, p 942-954, August 1971. 6 fig, 6 tab, 16 ref. OWRR B-002-IA (13) and B-019 IA (2).

Descriptors: *Groundwater movement, *Withdrawal, *Confined water, *Steady flow, *Mathematical studies, Saturated flow, Discharge (Water), Aquifers, Isotropy, Phreatic lines, Flow nets, Water wells, Numerical analysis, Computer programs, Aquifer characteristics.

A theoretical and exact solution is presented for steady saturated flow to a fully penetrating well in an elliptical confined aquifer; the aquifer is considered isotropic and homogeneous. The potential and stream functions for a number of different-shaped aquifers and well locations are developed by starting with a general solution to Laplace's equation and using a modified Gram-Schmidt method. Flow tables are presented for a number of geometries. For example, the tables show that a well 6 inches in diameter, located in the center of an elliptical aquifer with a ratio of minor to major axis of 1/2 and a major axis 1000 feet long, provides 0.857 as much discharge as a well located on the major axis of an elliptical aquifer seven-eighths of the way from the center to the edge. The variety of geometrics considered enables prediction of the well discharge for aquifers that approach the shape of an ellipse. Flow net examples are presented. (Knapp-USGS)
W71-13801

MAINE BASIC-DATA REPORT NO 7, GROUND-WATER SERIES MEDUXNEKEAG RIVER - PRESTILE STREAM BASINS AREA,
Geological Survey, Augusta, Me.
For primary bibliographic entry see Field 07C.

W71-13826

GEOHYDROLOGY OF ATCHISON COUNTY, NORTHEASTERN, KANSAS,
Kansas Geological Survey, Lawrence.
For primary bibliographic entry see Field 04B.
W71-13842

PROSPECTS FOR DEVELOPING STOCK-WATER SUPPLIES FROM WELLS IN NORTHEASTERN GARFIELD COUNTY, MONTANA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04B.
W71-13844

OCCURRENCE OF GROUNDWATER IN KIMBALL COUNTY, NEBRASKA INCLUDING LOGS OF TEST HOLES,
Nebraska Univ., Lincoln, Conservation and Survey Div.
For primary bibliographic entry see Field 04B.
W71-13845

ARTIFICIAL GROUND-WATER RECHARGE PROGRESS REPORT,
For primary bibliographic entry see Field 04B.
W71-13847

WATER-RESOURCES APPRAISAL OF ANTELOPE VALLEY AND EAST WALKER AREA, NEVADA AND CALIFORNIA,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 02E.
W71-13850

WATER RESOURCES OF NORTH-CENTRAL OAHU, HAWAII,
Geological Survey, Washington, D.C.
J. C. Rosenau, E. R. Lubke, and R. H. Nakahara.
Available from SOD, GPO, Wash, D.C., Price 30 cents. Geological Survey Water-Supply Paper 1899-D, 1971. 40 p, 17 fig, 5 tab, 22 ref.

Descriptors: *Hawaii, *Water resources, *Groundwater, *Fresh water, Rainfall, Water sources, Springs, Water supply, Water wells, Water utilization, Irrigation, Groundwater movement, Underseepage, Permeability, Natural recharge, Aquifers, Lava, Pumice, Hydrogeology.
Identifiers: *Oahu (Hawaii).

North-central Oahu, situated between the Waianae Range on the west, and the windward Koolau Range on the east, covers an area of approximately 152 square miles. About half of this area is above the 1,000-foot level and receives some 71% (413 mgd) of the area's annual rainfall. Groundwater availability is principally from wells located within highly permeable volcanic deposits. Most groundwater levels are between 5 to 300 feet above sea level depending upon the underlying geologic structure. The average water consumption is about 93 mgd, of which 75 mgd is used for irrigation purposes. The remainder is consumed for domestic and industrial uses. Groundwater movement is generally toward the coast with discharge in the form of springs. Some submarine springs occur in and beyond the coastal tidal zone. (Glasby-USGS)
W71-13855

SINKHOLE PROBLEM IN AND NEAR ROBERTS INDUSTRIAL SUBDIVISION, BIRMINGHAM, ALABAMA,
Geological Survey, University, Ala.
J. G. Newton, and L. W. Hyde.
Alabama Geological Survey Circular 68, 1971. 42 p, 19 fig, 1 tab, 8 ref.

Descriptors: *Sinks, *Land subsidence, *Water level fluctuations, *Alabama, Karst, Limestones, Clays, Carbonate rocks, Groundwater movement, Subsidence, Water table, Withdrawal.
Identifiers: *Birmingham (Ala).

Sinkholes in and near Roberts Industrial Subdivision along Village Creek in Birmingham, Ala., have resulted in coastly damage, major pollution, and narrowly averted accidents. It is estimated that more than 200 collapses and areas of subsidence formed in an area of less than half a square mile during 1963-70. Sinkholes and subsidence have occurred in streets and parking lots, beneath railroads, sewer and water mains, office buildings, warehouses, and highways. A major lowering of the water table, estimated to be as much as 140 feet, resulting from groundwater withdrawals, makes the area prone to the developments of sinkholes. Barring a recovery of the water table, sinkholes will continue to form with the greatest activity occurring during months of heavy rainfall. The formation of sinkholes results from the collapse of cavities in residual clay, created by 'spalling' or the downward migration of clay through openings in underlying carbonate rocks. The spalling and formation of cavities is caused by or may be accelerated by lowering of the water table resulting in a loss of support to clay, fluctuation of the water table, downward movement of water through openings in clay, and increase in velocity of groundwater. (Knapp-USGS)
W71-13856

SUBSURFACE DRAINAGE OF CHEMICALS IN THE USSR (Podzemnyy khimicheskiy stok na territorii SSSR),
Akademiya Nauk SSSR, Moscow. Geologicheskii Institut.
F. A. Makarenko, and V. P. Zverev.
Litologiya i Poleznyye Iskopayemyye, No 6, p 30-37, November-December 1970. 1 fig, 4 tab, 15 ref.

Descriptors: *Subsurface waters, *Subsurface drainage, *Hydrogeology, *Groundwater, *Chemical analysis, Solutes, Salts, Ions, Salinity, Topography, Folds (Geology), Structural geology, Orography, Permafrost, Subsurface mapping, Contours, Zoning, Distribution patterns.
Identifiers: *USSR, *Chemical drainage, European USSR, Siberia, Kazakhstan, Central Asia, Soviet Far East, Mineralization, Chemical denudation, Landscapes.

Subsurface drainage, as a fundamental mechanism for the migration of chemical elements in the earth's crust, was examined to determine its basic distribution patterns within various tectonic structures and regions of the USSR. The regions examined include the European USSR, Siberia, the Soviet Far East, Kazakhstan, and Central Asia. Changes in chemical subsurface drainage depend upon a number of factors: (1) the age of folding, increasing from ancient to more modern structures; (2) the intensity of tectonic movements; (3) the relief; and (4) the type of landscape, etc. Mapping of the modulus of chemical subsurface drainage in the USSR provides the most complete picture of its properties, its magnitude and its variations in space. The aggregate removal of salts by subsurface waters represents 278.89 million metric tons/yr or 54.3% of the total solutes participating in chemical drainage in the USSR. (Josefson-USGS)
W71-13861

FORMATION OF SUBSURFACE FLOW IN KAZAKHSTAN (Formirovaniye podzemnogo stoka na territorii Kazakhstnaa).
Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Institut Gidrogeologii i Gidrofiziki.

Izdatel'stvo 'Nauka', Akhmedsafin, U.M., Editor-in-chief, Alma-Ata, 1970. 148 p.

Descriptors: *Subsurface flow, *Subsurface runoff, *Groundwater, *Groundwater movement, *Hydrogeology, Base flow, Groundwater recharge, Groundwater basins, Confined water, Aquifers, Low flow, Discharge (Water), Runoff, Precipitation (Atmospheric), Geologic formations, Geomorphology, Infiltration, Climatic data, Maps, Regions.

This monograph is devoted to a detailed study of the formation of subsurface flow in Kazakhstan and to a regionalization of the Republic based on the flow of groundwater through the principal water-bearing formations and aquifer complexes. A total of 7 hydrogeological regions and 23 hydrogeological subregions were identified and evaluated. The volume of subsurface flow for Kazakhstan was estimated to be 1,533 cu m/sec or 48,300 million cu m/yr, of which 1,387 cu m/sec or 43,700 million cu m/yr is the flow under water table conditions and 146 cu m/sec or 4,600 million cu m/yr is the artesian flow. Methods are given for determining the following components of subsurface flow in the Republic: (1) subsurface flow of rivers; (2) local subsurface flow in aquifers of small areas; (3) nonlocal subsurface flow from adjacent areas of groundwater recharge; and (4) total subsurface flow composed of local and nonlocal subsurface flow, representing the total discharge of water-bearing formations and aquifer complexes. Three maps, showing the distribution of aquifers and aquifer complexes, the groundwater mineralization, and the nonlocal subsurface flow in various deep horizons of artesian basins, were used to describe the subsurface flow in the Republic. These maps are (1) a map of subsurface flow showing isolines of average long-term specific discharges expressed in liter/sec/sq km; (2) a map of subsurface flow expressed in mm of runoff depth per year; and (3) a map showing isolines of average annual coefficients of subsurface flow expressed in percent of atmospheric precipitation. (Josefson-USGS)
W71-13863

DENSITY LOGS FROM UNDERGROUND GRAVITY SURVEYS IN HAWAII,
Hawaii Univ., Honolulu.
Richie D. Huber, and William M. Adams.
PB-203 492 MF $0.95. Hawaii University Water Resources Research Center Technical Report No 45, Project Completion Report of Remote Sensing of Water With Electromagnetic Radiation From 1/10 to 10 to the 15th power hertz, February 1971. 39 p, 10 fig, 4 tab, 15 ref, 2 append. OWRR Project B-015-HI (4).

Descriptors: *Borehole geophysics, *Gravity studies, *Hawaii, *Porosity, *Hydrogeology, Density, Permeability, Surveys, Aquiers, Logging (Recording), Basalts, Water wells, Subsurface investigations, Gravimeters.
Identifiers: Gravity surveys (Hawaii).

The gravity method was applied in three wells in Hawaii to estimate density and porosity logs. The wells are the Schofield shaft on the island of Oahu, the Kihei no. 3 shaft on the island of Maui and the Pahala shaft on the island of Hawaii. The method determines the 'averaged' density and porosity values for Hawaiian rocks. On Oahu, the density at depth is 2.4 gm/cc and the corresponding porosity is 18%. For Maui, the density averages about 2.4 gm/cc and porosity at 17%. The Hawaii shaft shows a lower density of 2.0 gm/cc with a corresponding higher porosity of 27%. All these values are based on a grain density of 2.9 gm/cc. (Knapp-USGS)
W71-13906

SUBSURFACE WASTE DISPOSAL BY MEANS OF WELLS--A SELECTIVE ANNOTATED BIBLIOGRAPHY,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05E.
W71-13909

UNSTEADY DRAWDOWN IN WELL GROUPS,
Northwestern Univ., Evanston, Ill. Technological Inst.
For primary bibliographic entry see Field 04B.
W71-13918

A PROGRAM TO SIMULATE AN AQUIFER USING ALTERNATING DIRECTION IMPLICIT-ITERATIVE PROCEDURE,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-13933

EXAMINATION OF DRILL CUTTINGS AND APPLICATION OF RESULTING INFORMATION TO SOLVING OF FIELD PROBLEMS ON THE NAVAJO INDIAN RESERVATION, N. MEX. AND ARIZ.,
Geological Survey, Washington, D.C.
P. R. Stevens.
U.S. Geological Survey Water Supply Paper 1544-H, p H3-13, 1963. 1 tab, 4 ref.

Descriptors: *Water wells, Drilling, Rotary drilling, Drilling equipment, *India reservations, New Mexico, Arizona.
Identifiers: Cable-tool drilling, Test holes, Sampling, *Drill cuttings, Description of cuttings, Identification of stratigraphic units.

Only by drilling test holes and wells can detailed information on subsurface geologic and hydrologic conditions be obtained. The value of the information thus collected depends on the care exercised in sampling the rock cuttings, the thoroughness of the microscopic examination, and the accuracy and completeness of the lithologic and hydrologic descriptions. The more subsurface information compiled for an area, the better the understanding of the stratigraphy and geologic structure and the greater the success in locating water supplies from ground-water sources. This paper is based on experience gained in making a geologic and hydrologic study of the Navajo Indian Reservation, N. Mex. and Ariz. (Campbell-NWWA)
W71-13970

2G. Water in Soils

SOIL SOLUTION COMPOSITION AND STABILITY OF CLAY MINERALS,
Washington State Univ., Pullman. Coll. of Agriculture.
J. A. Kittrick.
Soil Science Society of America Proceedings, Vol 35, No 3, p 450-454, May-June 1971. 5 p, 1 fig, 26 ref. OWRR Project A-042 (WASH) (1).

Descriptors: *Aqueous solutions, *Water chemistry, *Soil chemistry, *Clay minerals, *Thermodynamics, *Free energy, Solubility, Ion exchange, Equilibrium, Chemical potential, Montmorillonite, Chemical reactions, Silicates, Mineralogy.
Identifiers: Soil solution.

Common minerals, such as the silicates, usually have very low solubilities and slow rates of dissolution and precipitation in the soil solution. This has tended to obscure the fact that their equilibrium reactions with the soil solution can actually be described by elementary thermodynamics. Ion analyses for soil solution-mineral equilibria involve the same procedures and problems as do most other chemical analyses of the soil solution. The same is true for calculation of ionic strength, ion activities, equilibrium constants, and delta G values. The usefulness of delta G values for common soil minerals is greatly enhanced when suitable stability equations are derived from them. These stability equations can be graphed to reveal the control of weathering relationships by the composition of the soil solution. This is illustrated for the mineral group consisting of amorphous silica, montmorillonite, kaolinite, and gibbsite. The stability equations can also be used to construct equilibrium composition models for elements in the soil solution. (Knapp-USGS)
W71-13147

HYDROLOGIC RECONNAISSANCE OF GROUSE CREEK VALLEY, BOX ELDER COUNTY, UTAH,
Geological Survey, Salt Lake City, Utah.
For primary bibliographic entry see Field 02E.
W71-13509

THE ANCIENT ERG OF HAUSALAND IN SOUTH-WESTERN NIGER,
Hunting Technical Services Ltd., Boreham Wood (England).
L. P. White.
Geographical Journal, Vol 137, No 1, p 69-73, March 1971. 1 fig, 2 tab, 5 ref.

Descriptors: *Geomorphology, *Soil types, *Water balance, *Aeolian soils, *Rainfall, Arid lands, Subhumid climates, Sands, Laterites, Vegetation, Infiltration, Soil profiles, Soil horizons, Soil formation, Groundwater, Drainage basins.
Identifiers: *Niger, *Ergs (Geomorphic).

The Ancient Erg of Hausaland is a part of a semicontinuous sand sheet extending from the central Sahara, representing past desert incursions, into now more humid areas. The highest geomorphic level is a laterite plateau and there is an extensive second level plateau in the south. Gently undulating flat-floored trenches show traces of anastamosing networks of narrow channels. In the higher rainfall southern areas, the trenches contain permanent swamps that tap shallow groundwaters of the sandy deposits. Between the trenches and the plateau escarpment interfluves is a slooping intermediate erosion surface with an inactive drainage network. Superimposed upon the landscape are extensive areas of wind-blown sand, new fixed by vegetation and showing very little relief. These aeolian sands derived material in lower lying situations. Soil analysis, including descriptions of horizons and profiles, reveals an almost complete succession of zonal soils corresponding to increases in climatic wetness from north to south. Though the soils are poor in nutrients, their highly moisture absorbent surfaces result in a luxuriant vegetation cover and minimal runoff. (Casey-Arizona)
W71-13586

A COMPARISON OF DEEP AND SHALLOW DRAIN TILE FOR REDUCTION OF SOIL SALINITY IN IMPERIAL VALLEY.
California Univ., Davis. Dept of Water Science.
For primary bibliographic entry see Field 03C.
W71-13592

DISTRIBUTION OF PLANT COMMUNITIES IN SOUTH-EASTERN MONTANA BADLANDS,
Forest and Range Experiment Station, Ogden, Utah.
For primary bibliographic entry see Field 02I.
W71-13599

USING SOIL FILTRATION TO REDUCE POLLUTION POTENTIAL OF LAGOON EFFLUENT ENTERING GROUND WATER SYSTEM,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 05D.
W71-13656

RELEASE OF HERBICIDES FROM CLAY MINERALS AS A FUNCTION OF WATER CONTENT: I. Kaolinite,
North Carolina State Univ., Raleigh. Agricultural Experiment Station.
For primary bibliographic entry see Field 05B.
W71-13797

EFFECT OF SELECTED FACTORS ON PESTICIDE SORPTION AND DESORPTION IN THE AQUATIC SYSTEM,
Missouri Univ., Rolla. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W71-13800

MODELING THE INFILTRATION COMPONENT OF THE RAINFALL-RUNOFF PROCESS,
Minnesota Univ., St. Paul. Water Resources Research Center.
Russell G. Mein, and Curtis L. Larson.

Available from the National Technical Information Service as PB-203 423, $3.00 in paper copy, $0.95 in microfiche. Minnesota Water Resources Research Center, St. Paul, Bulletin 43, September 1971. 72 p, 25 fig, 11 tab, 48 ref. OWRR A-023-MINN (1).

Descriptors: *Infiltration, *Rainfall-Runoff relationship, *Watersheds, Soil type, Rainfall intensity, *Model studies.
Identifiers: *Infiltration model, Infiltration capacity, Capillary suction, Green-Ampt equation.

A simple infiltration model is proposed for the idealized case of a constant intensity rainfall infiltrating into a homogeneous soil at uniform initial moisture content. The infiltration volume prior to the beginning of runoff is predicted from a modified form of Darcy's Law. The succeeding infiltration capacity 'decay' curve is described by the Green and Ampt equation with a correction included to allow for the volume of infiltration prior to surface saturation. All parameters in the model can be obtained from the rainfall intensity and measurable properties of the soil; no fitting is required. The model equations were tested against numerous solutions of the diffusion equation for soil moisture flow. Comparisons were made for five different soil types (sand, sandy loam, loam, silt loam, light clay) and for a variety of rainfall intensities and initial soil moisture levels. A further independent test of the prediction of the water uptake before runoff was made against published experimental observations. Good to excellent agreement was obtained for all tests except in the case of the silt loam, for which agreement was fair. (Walton-Minnesota)
W71-13806

SINKHOLE PROBLEM IN AND NEAR ROBERTS INDUSTRIAL SUBDIVISION, BIRMINGHAM, ALABAMA,
Geological Survey, University, Ala.
For primary bibliographic entry see Field 02F.
W71-13856

A SOIL ERODIBILITY NOMOGRAPH FOR FARMLAND AND CONSTRUCTION SITES,
Agricultural Research Service, Lafayette, Ind. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02J.
W71-13910

EFFECT OF ROW GRADES AND TILLAGE SYSTEMS ON SOIL AND WATER LOSSES,
Agricultural Research Service, Ames, Iowa. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02J.
W71-13911

GENERAL SOIL MAPS - A STUDY OF LANDSCAPES,
Soil Conservation Service, Washington, D.C.
Lindo Bartelli.
Journal of Soil and Water Conservation, Vol 21, No 1, January-February 1966. p 3-6, 2 fig, 3 photo, 1 tab, 16 ref.

Descriptors: *Landscaping, *Soil surveys, *Soil types, *Land classification, *Land use, *Resources.
Identifiers: *Soil map, *Landscape, *Regional land use plan, *Regional planners, Soil behavior, Soil supply, Soil unit.

The soil landscape is an integral part of the basic inventory required by any regional land use plan. General soil maps, which identify and describe landscapes, provide an economical inventory of soil resources and an effective introduction to detailed soil surveys. Procedures for converting the complex soil units of soil surveys into terms readily understandable by regional planners are described in this article. (Strachan-Chicago)
W71-13957

EFFECT OF RECREATIONAL USE ON SOIL AND MOISTURE CONDITIONS IN ROCKY MOUNTAIN NATIONAL PARK,
For primary bibliographic entry see Field 04C.
W71-13958

2H. Lakes

METHODS OF HYDROBIOLOGY (FRESHWATER BIOLOGY),
For primary bibliographic entry see Field 02I.
W71-13101

SOME LIMNOLOGICAL OBSERVATIONS FROM ENDERBY LAND, ANTARCTICA,
Lehigh Univ., Bethlehem, Pa. Central Marine and Environmental Studies.
For primary bibliographic entry see Field 02C.
W71-13103

LIMNOLOGICAL OBSERVATIONS ON LAKE KARIBA DURING 1967 WITH EMPHASIS ON SOME SPECIAL FEATURES,
Lake Kariba Fisheries Research Inst. (Rhodesia).
For primary bibliographic entry see Field 05C.
W71-13104

ACETYLENE REDUCTION (NITROGEN FIXATION) IN WISCONSIN LAKES,
Department of Agriculture, Fargo, N. Dak. Metabolism Lab.
For primary bibliographic entry see Field 05C.
W71-13105

BIOTIC DIVERSITY IN THE MACROBENTHOS OF THE LAKES OF MERGOZZO AND BOLSENA,
Delio Ruggiu.
Mem Ist Ital Idrobiol Marco Marchi. 25: 49-63, Illus, 1969 (Engl summ).
Identifiers: Benthos, Biotic, Bolsena, Density, Diversity, Fauna, Formula, Italy, Lakes, Macro, Mergozzo, Population, Shannon.

The diversity, expressed by Shannon's formula, of the macrobenthic fauna of Lake Mergozzo and Lake Bolsena is negatively correlated with depth, and positively correlated with species number, H''/H'' sub max (Shannon and Weaver's diversity index), and O2 concentration. Benthic communities at different depths have characteristic diversity values. The modifications of diversity with time are generally much less remarkable than those of population density.--Copyright 1971, Biological Abstracts, Inc.
W71-13107

LIMNOLOGY OF TROPICAL IMPOUNDMENTS: A COMPARATIVE STUDY OF THE MAJOR RESERVOIRS IN MADRAS STATE (INDIA),
Hydrobiological Research Station, Madras (India).
For primary bibliographic entry see Field 05C.
W71-13109

THE MAJOR CATIONS IN LAKE MARYUT WATERS,
Alexandia Univ. (Egypt). Faculty of Sciences.
Saad K. El-Wakeel, Selim A. Morcos, and A. M. Mahlis.
Hydrobiologia. 36 (2): 253-274, Illus, Maps, 1970.
Identifiers: Cations, Lake, Maryut, Minerals, Salinity, Seasonal, United-Arab-Republic, Variations, Waters.

The concentrations of Na, K, Ca and Mg in Lake Maryut water were determined at 6 stations representing the different regions of the lake during 1966. The Na content varied seasonally and regionally with an annual average value of 1.0332 g/kg. The K content varied also seasonally and regionally following the Na variation, with an annual

average content of 0.0585 g/kg. The K concentration in the lake water forms about 4.5% that of Na, compared with 3.6% in sea water and 21.6% in fresh water. The average Na/Cl ratio varied between a maximum in autumn and a minumum in summer. Contrary to the Na/Cl ratio, the K/Cl ratio was more or less correlated with salinity variations where it increased in summer and decreased in winter. The annual average Na/Cl ratio of 0.6345 for the lake water was higher than the average ratio of 0.5555 given for sea water. The K/Cl ratio had an annual average value of 0.0339 which is again higher than the average ratio of 0.0208 for sea water. The Na and K chlorinity ratios decreased with the increase of chlorinity. The Ca content in the lake water reached its maximum in summer and its minimum in autumn with an annual average content of 0.0549 g/kg. The Ca/Cl ratio for the lake water had an average value of 0.0335 which is higher than the ratio of 0.02126 for oceanic water. It increased by the increase of chlorinity and subsequently followed the salinity variation in the lake water. It also varied regionally following the distribution of carbonates in the bottom sediments. The Mg content in the lake water had an annual average of 0.1201 g/kg. The Mg/Cl ratio increased by the increase of chlorinity, with an annual average value of 0.0733 which is higher than the average ratio of 0.06692 for sea water. Similar to Ca the Mg/Cl ratio followed more or less the seasonal variation of salinity. The Mg/Cl ratio varied slightly from 1 region to another, with a slight westward increase in the lake. The average Mg/Cl ratios were the same at the 6 stations and the annual average ratio was 0.0733.--Copyright 1971, Biological Abstracts, Inc.
W71-13112

THE MAJOR ANIONS IN LAKE MARYUT WATERS,
Alexandria Univ. (Egypt). Faculty of Sciences.
A. M. Mahlis, Selim A. Morcos, and Saad K. El-Wakeel.
Hydrobiologia. 36 (2): 275-294, Illus, Maps, 1970.
Identifiers: Alkalinity, Anions, Chlorinity, Lake, Maryut, United-Arab-Republic, Waters.

Determinations for sulphate, bromide content and the alkalinity of Lake Maryut water were carried out at 6 stations during the 4 seasons of 1966. The sulphate chlorinity ratio increased with the decrease of chlorinity. It had an average of 0.2649 which is higher than the ratio of 0.1395 for sea water and lower than the ratio for river waters. Regional variations in the SO4/Cl ratio are attributed to the effect of drainage water which have a high sulphate content. The average bromine chlorinity ratio 0.00360 was compared with 0.00348 for sea water. The seasonal and regional variation of the Br/Cl ratio was less significant than the SO4/Cl ratio. The specific alkalinity decreased with the increase of chlorinity. The average specific alkalinity for the lake water was 3.20 which is higher than that for sea water, (0.126), and lower than that for river waters.--Copyright 1971, Biological Abstracts, Inc.
W71-13113

MACROINVERTEBRATES OF FLOODED TREES IN THE MAN-MADE VOLTA LAKE (GHANA) WITH SPECIAL REFERENCE TO THE BURROWING MAYFLY POVILLA ADUSTA NAVAS,
Makerere Univ., Kampala (Uganda). Dept. of Zoology.
T. Petr.
Hydrobiologia. 36 (3/4): 373-398, Illus, Map, 1970.
Identifiers: Algae, Burrowing, Chironomid, Fish, Flooded, Ghana, Invertebrates, Lake, Macro, Man, Mayfly, Phyto, Plankton, Povilla-Adusta, Trees, Volta.

The species composition of periphytic macroinvertebrates on and in flooded trees differs at different localities in the Volta Lake chironomid and trichopteran larvae especially due to the different exposure of trees to wave action, in the availability of soft wood and bark as a substrate, and in the distance of trees off-shore. All these factors determine the intensity of growth of the periphytic algae. The growth of the periphytic fauna is also influenced by the density of phytoplankton on which it feeds. Other factors, such as O2 concentration and the turbidity of the water, are also likely to affect the productivity of the whole community. The abundance of Povilla nymphs, the most common organism in trees, seems to depend on the type of the substrate. The bark of trees is exploited more than the wood, and trees with harder wood are less attacked than those with soft wood. Macroscopically, the male nymphs can be distinguished from female nymphs from a length of 6 mm, and they start to emerge when 9 mm long. Females emerge from 14 mm length. Nymphs tend to be heavier in dense populations. The difference in the weight of nymphs may be due to differences in availability of food. Nymphs of Povilla fed both on solitary and attached periphytic algae, together with detritus and planktonic algae. Because of the great abundance of Povilla the nymphs of this species are of great importance in the conversion of algae into animal protein, being themselves heavily exploited by fish. No lunar periodicity, such as occurs on Lake Victoria, was found, and Povilla in the Volta Lake seems to emerge continuously.--Copyright 1971, Biological Abstracts, Inc.
W71-13116

MUDLUMPS AND SUGGESTED GENESIS IN PYRAMID LAKE, NEVADA,
Desert Research Inst., Reno, Nev.
For primary bibliographic entry see Field 02J.
W71-13144

THE PHYTOPLANKTON OF MINNESOTA LAKES - A PRELIMINARY SURVEY,
Minnesota Univ., Minneapolis. Water Resources Research Inst.
For primary bibliographic entry see Field 05C.
W71-13149

LARGE-SCALE OSCILLATORY MOTIONS AND SEASONAL TEMPERATURE CHANGES IN LAKE MICHIGAN AND LAKE ONTARIO,
Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.
C. H. Mortimer.
Wisconsin Univ, Milwaukee, Center for Great Lakes Studies, Special Report No 12, 1971. Part I, 111 p, text, 10 tab, 66 ref. Part II, 106 p, illustrations.

Descriptors: *Hydrologic cycle, *Temperature, *Waves (Water), *Currents (Water), Lake Michigan, Lake Ontario, International Hydrological Decade, Channels, Lakes, Mathematical models, Surges, Winds, Seiches.
Identifiers: *Temperature cycles, *Upwelling, Long internal waves, Rotation effects.

A preparatory analysis is presented of temperature and dynamics of Lake Michigan and Lake Ontario, prepared for the International Field year on the Great Lakes. The four chapters of the document include detailed information on the following parameters of the two lakes: Annual temperature cycle; Upwelling of coastal waters and the generation of long internal waves; Theory of the internal waves as influenced by rotation; Temperature oscillations and currents. The text of each chapter is supplemented by an ample number (20 to 30) of annotated illustrations. Chapter 5 presents a comprehensive summary. (Wilde-Wisconsin)
W71-13178

SR-85 AND CS-134 UPTAKE BY FRESHWATER SESTON,
European Atomic Energy Community, Ispra (Italy). Biology Div.
For primary bibliographic entry see Field 05C.
W71-13231

BACTERIA-ALGAE SYMBIOSIS - A CAUSE OF ALGAL BLOOMS,
Wyandotte Chemicals Corp., Mich.
For primary bibliographic entry see Field 05C.
W71-13257

ANALYSIS OF VARIATIONS IN DISSOLVED OXYGEN IN AN IMPOUNDMENT IN CENTRAL ILLINOIS,
Illinois State Water Survey, Peoria. Water Quality Section.
For primary bibliographic entry see Field 05B.
W71-13287

HOLOCENE CARBONATE ACCUMULATION CONDITIONS IN BELORUSSIAN LAKE BASINS, (Usloviya sovremennogo karbonatonakopleniya v ozernykh basseynakh Belorussii),
Akademiya Navuk BSSR, Minsk. Laboratoriya Geokhimicheskikh Problem.
K. I. Lukashev, A. L. Zhukhovitskaya, and A. A. Khomich.
Akademiya Nauk SSSR Doklady, Vol 193, no 2, p 425-428, 1970. 1 fig, 2 tab, 13 ref.

Descriptors: *Lake basins, *Lake morphology, *Limnology, *Calcium carbonate, *Sedimentation, Lake morphometry, Geochemistry, Geomorphology, Bottom sediments, Physicochemical properties, Zoning, Salinity, Carbon dioxide, Supersaturation, Equilibrium, Water temperature.
Identifiers: *USSR, Belorussia, Holocene epoch, Lake sediments.

A number of Belorussian lakes were examined for establishing geochemical zoning in the distribution of Holocene carbonate sediments. This zoning is dependent upon soil, climatic, geologic and geomorphologic factors which ensure optimal conditions for leaching, migration and accumulation of calcium carbonate. The lakes selected for study differ in (1) the topographic and geochemical conditions of their basin areas, (2) the physico-geographic characteristics of their basins, (3) the hydrochemical, hydrodynamic and hydrobiological properties of their water and (4) the composition of their bottom sediments. Carbonate sediments are found mainly in the lake basins of western regions. Silicate, organic silicate and organic sediments predominate in the northern and southern parts of the Republic. Carbonate sedimentation and accumulation in lacustrine deposits depend upon the morphometry, hydrodynamics, temperature and other limnological conditions of lake basins, which determine the physicochemical properties of their water. Negative conditions of carbonate formation prevail in lakes with a stable acidic water reaction. Positive conditions for carbonate accumulation are created mainly in lakes with a complex basin structure, where extensive open areas of shallow water are much more common than small areas of deep water. The background carbonate sedimentation in Belorussian lake basins is due to the high carbonate content of glacial sediments and to the stable supersaturation of the water. The common overall trends of processes whereby carbonate material is supplied, formed, precipitated, and stabilized ensures a high net present-day carbonate accumulation. (Josefson-USGS)
W71-13304

DIATOMS IN LAKES AND LAKE SEDIMENTS AS AN INDEX TO ENVIRONMENT (PROGRESS REPORT, MAY 1, 1970 TO JANUARY 31, 1971,
Minnesota Univ., Minn.
For primary bibliographic entry see Field 05C.
W71-13383

PROBLEMS ASSOCIATED WITH THE QUANTITATIVE STUDY OF LAKE BALANCE BY MEANS OF THE CONCENTRATIONS OF DEUTERIUM AND/SUP 18/O IN THE WATER,
Commissariat A l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
Liliane Merlivat.

Available from the National Technical Information Service as CEA-CONF-1538, $3.00 in paper copy, $0.95 in microfiche. Report CEA-CONF-1538, March 13, 1970. 29 p, 7 fig, 15 ref.

Descriptors: *Evaporation, *Stable isotopes, *Heavy media separation, *Separation techniques, Deuterium, Heavy water, Tracers, Water types, Oxygen, Water balance, Foreign research, Reservoir evaporation, Diffusion, Humidity, Microenvironment, Water vapor, Lakes, Turnovers.
Identifiers: *Oxygen isotopes O-18, Isotopic fractionation.

Isotopic fractionation of water was studied during evaporation with natural turbulence. Experimentally, for (1-D/DD)/ (1-D/DO-18) the value 0.85 was determined which compares with the theoretical value of 0.53. (D, DD, and DO-18 are the diffusion coefficients in air of the molecules H2O, HDO, and H2O (0-18), respectively). Further experiments are being conducted to show reasons for the deviation from theory. In a study of three Turkish lakes, the isotopic fractionation occurring during evaporation loss could not be assessed directly since the humidity was unknown. However from the isotopic compositions of the lakes and of the inflowing water and the fact that one of the lakes was not used for irrigation, the ratio of inflow to evaporation loss was estimated for the other lakes. For both lakes the estimates based on HDO and H2 (0-18), respectively, were in satisfactory agreement. (Bopp-NSIC)
W71-13387

EFFECT OF URBAN SALT RUNOFF ON LAKE STRATIFICATION,
State Univ., of New York Coll. at Oswego. Lake Ontario Environmental Lab.
For primary bibliographic entry see Field 05B.
W71-13441

NUMERICAL CALCULATIONS OF THE WIND-DRIVEN CURRENTS IN LAKE ERIE AND COMPARISION WITH MEASUREMENTS,
National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center.
R. I. Gedney, and W. Lick.
National Aeronautics and Space Administration (NASA) Technical Memorandum NASA TM X-67804, 1971. 19 p, 7 fig, 1 tab, 7 ref. (Paper presented at 14th Great Lakes Conf, Toronto, Canada, April 19, 1971).

Descriptors: *Water circulation, *Winds, *Currents (Water), *Lake Erie, *Numerical analysis, Model studies, Mathematical studies, Data collections, Wind velocity, Lakes.
Identifiers: *Wind-driven water currents.

The steady-state, wind driven velocities in Lake Erie were calculated numerically using a shallow lake model. The three-dimensional velocities as a function of depth and horizontal position are displayed for the prevailing southwest winds. The velocities vary greatly from position to position and depend strongly on the bottom topography and boundary geometry. For the numerical calculations, a 0.805 kilometer grid size in an island region and a 3.22 kilometer grid size in the rest of the lake was incorporated to adequately represent the Lake Erie geometry. The calculated velocities agree quantitatively with current meter measurements made at mid-depths in the Central and Eastern basins. The magnitudes of the average eddy viscosity used in the calculations agree with measurements made in the Great Lakes. Steady currents usually occur after two days of fairly uniform winds. (Woodard-USGS)
W71-13449

COSMOGENIC Na22 IN SURFACE WATERS OF ARID REGIONS (Kosmogennyy Na22 v poverkhnostnykh vodakh sushi),
Akademiya Nauk SSSR, Leningrad. Institut Evolyutsionnoi Fiziologii i Biokhimii.
D. G. Fleyshman and Yu. P. Kanevskiy.
Akademiya Nauk SSSR Doklady, Vol 198, No 6, p 1397-1400, 1971. 1 tab, 12 ref.

Descriptors: *Sodium, *Radioisotopes, *Surface waters, *Rivers, *Lakes, Arid lands, Precipitation (Atmospheric), River flow, Groundwater recharge, Evaporation, Time lag, Tracers, Water balance.
Identifiers: *USSR, *Sodium radioisotopes, Lake Ladoga, Lake Onega, Lake Saimaa, Lake Ilmen, Neva River, Svir' River, Vuoksi River, Volkhov River.

Of the cosmogenic radionuclides formed in the earth's atmosphere, H3 with a half-life of 12.3 years and Na22 with a half-life of 2.6 years are the most suitable for studying hydrologic processes in nature. To determine the concentrations of Na22 in atmospheric precipitation and in lake-river systems, investigations were conducted in the Neva River basin on Lakes Onega, Saimaa and Ilmen, connected to Lake Ladoga by the Svir' Vuoksi and Volkhov Rivers. The Na22 content in the waters of the Svir', Vuoksi and Volkhov Rivers was calculated directly by formula. The Na22 content in the water of the Neva River was determined from the contribution to the water balance of the Lake Ladoga of (1) the flow of each of the three tributaries; (2) the total flow of the small rivers; (3) the atmospheric precipitation; (4) the groundwater recharge; and (5) the evaporation from the lake surface. Actual concentrations of Na22 in the waters of the Svir' ad Neva Rivers approached calculated values; for the Vuoksi and Volkhov Rivers the actual values were approximately one-half the theoretical values. The differences between the theoretical and empirical values may be explained by the arbitrary selection of average time lag parameters in the river basin without allowance for the effects of specific basin conditions. (Josefson-USGS)
W71-13501

THE PALEOLIMNOLOGY OF FOUR LAKES IN SOUTH-WESTERN FINLAND,
Helsinki Univ. (Finland). Dept. of Geology and Paleontology.
Pentti Alhonen.
Annales Academiae Scientiarum Fennicae, Series A, III. Geologica-Geographica, No 105, March 1970. 39 p, 20 fig, 2 tab, 58 ref.

Descriptors: *Paleolimnology, *Ecosystems, *Lakes, *Bottom sediments, *Sedimentation, Sedimentation rates, Lake stages, Palynology, Diatoms, Crustaceans, Biomass, Sampling, Chemical analysis, Radioactive dating, Organic matter, Carbon, Nitrogen, Plankton.
Identifiers: *Finland, Lake sediments, Chemostratigraphy, Biostratigraphy, Lithostratigraphy, Pollen analysis, Sediment cores, Paludification.

Sediment cores were collected from four lakes in southwestern Finland for examining the life history and dynamics of lake ecosystems. The lakes studied, Telkko, Sarkijarvi, Jarvenkylanjarvi and Leppasjarvi, are all of the same age, isolated according to the diatoms from the Ancylus Lake. The isolation is indicated by a marked change from clay to clay-gyttja and gyttja sediments containing different diatom communities. The diatom successions of these lakes have remained oligotrophic throughout their flandrian development. The biostratigraphy of the diatoms, consisting of epipelic and epiphytic communites, may be associated with changes in the water level of the lake basins, especially in the lakes Telkko, Jarvenkylanjarvi and Leppasjarvi. These dynamics are clearly indicated by the subfossil cladoceran fauna. Based on its planktonic/littoral ratio, there are two pelagic, deep-water phases in these lakes (Atlantic and Sub-Atlantic periods). A clear littoral development with a low lake level occurred during the Sub-Boreal period and was often observed in the most recent history of the lakes. A chemical analysis of the ignition loss, water content, carbon, nitrogen, and C/N ratio of the lake sediments indicates a rapid increase in the organic content of the deposits. This phenomenon was reflected in the estimated sedimentation rate curves for all lakes, except Lake Jarvenkylanjarvi, where the greatest increase in the sedimentation rate occurred during the Sub-Atlantic period and in the most recent history of this lake. The high organic content of Lake Telkko during its growth phase may reflect a paludification of the environment. (Josefson-USGS)
W71-13503

KINETIC ASSESSMENT OF ALGAL GROWTH,
California Univ., Berkeley.
For primary bibliographic entry see Field 05C.
W71-13553

WATERSHED ANALYSIS RELATING TO EUTROPHICATION OF LAKE MICHIGAN,
Michigan State Univ., E. Lansing. Inst. of Water Research.
For primary bibliographic entry see Field 05C.
W71-13808

POMME DE TERRE LAKE BACTERIOLOGICAL STUDY (MISSOURI),
Environmental Protection Agency, Kansas City, Mo.
For primary bibliographic entry see Field 05B.
W71-13814

MIXING PROCESSES IN GREEN BAY,
Wisconsin Univ., Madison. Marine Studies Center.
W. F. Ahrnsbrak, and R. A. Ragotzkie.
University of Wisconsin Sea Grant Program Reprint WIS-SG-71-312 from Proceedings Thirteenth Conference on Great Lakes Research, April 1970, Buffalo, New York, International Association for Great Lakes Research p 880-890, 1970. 8 fig, 3 tab, 14 ref.

Descriptors: *Mixing, *Water quality, *Water types, *Bays, *Lake Michigan, Water pollution sources, Model studies, Analytical techniques, Chemical analysis, Diffusion, Conductivity, Sediment transport, Hydrologic data, Sedimentation, Data collections.
Identifiers: *Green Bay (Lake Michigan).

A one-dimensional diffusion model based on the principle of conservation of mass was applied to Green Bay, Lake Michigan. Observed diffusivities were compared with those predicted on the basis of seiche activity. Diffusivities in the vicinity of Long Tail Point were approximately 250,000 sq cm/sec with an abrupt jump to 1 million sq cm/sec a few km farther into the bay and gradually increasing to 3 million sq cm/sec in the central part of the Bay. Electrical conductivity and light transmissivity were used to observe the distribution of Fox River water in the Bay. Highest concentration gradients (40% km) were found in the vicinity of Long Tail Point and along the eastern shore of the southern end of the Bay. No appreciable transverse gradients were found in the mid and northern portion of the Bay. (Woodard-USGS)
W71-13828

APPRAISAL OF CHEMICAL AND BIOLOGICAL CONDITIONS OF LAKE OKEECHOBEE, FLORIDA, 1969-70,
Geological Survey, Tallahassee, Fla.
B. F. Joyner.
Geological Survey Open-file Report No 71006, 1971. 111 p, 8 fig, 15 tab, 31 ref, append.

Descriptors: *Water quality, *Water chemistry, *Lakes, *Florida, *Lake stages, Eutrophication, Water analysis, Chemical analysis, Hydrologic data, Data collections, Sedimentation, Biological properties.
Identifiers: *Lake Okeechobee (Fla), Water budget.

The chemical, physical and biologic properties of Lake Okeechobee in southern Florida were investigated from January 1969 through April 1971.

Organic nitrogen averaged 1.1 mg/liter (milligrams per liter) and accounted for approximately 80% of the total nitrogen, and total phosphorus (P) averaged 0.04 mg/liter. The average dissolved-solids content of the lake water was 260 mg/liter in 1969-70 compared to 190 mg/liter in 1940-41. Rainfall contributes significant amounts of nutrients to the lake, and concentrations in rain are at times similar to concentrations in both the lake and concentrations in rain are at times similar to concentrations in both the lake and its major tributaries. Rainfall contributes 25% of the total nitrogen and 16% of the total phosphorus load. Major tributary sources include the Kissimmee River, which contributes approximately 40% of the total nitrogen and phosphorus loads, and Taylor Creek, which contributes 28% of the total phosphorus load. Eighteen percent of the nitrogen and 32% of the phosphorus entering Lake Okeechobee is retained within the bottom sediments and biota. Water pumped from agricultural areas to the southeast is generally the poorest in quality of all water entering Lake Okeechobee. (Woodard-USGS)
W71-13849

THE WATER QUALITY OF SAM RAYBURN RESERVOIR, EASTERN TEXAS,
Geological Survey, Washington, D.C.
J. Rawson, and M. W. Lansford.
Available from SOD, GPO, Wash, D.C., Price 35 cents. Geological Survey Water-Supply Paper 1999-J, 1971. 67 p, 9 fig, 16 tab, 3 ref.

Descriptors: *Texas, *Reservoirs, *Water quality, *Water storage, Dams, Water supply, Water conservation, Sewage treatment, Water pollution sources, Industrial wastes, Waste assimilative capacity, Limnology, Thermal stratification, Convection, Thermocline, Hypolimnion, Epilimnion, Turnovers, Surface drainage, Dissolved oxygen, Dissolved solids.
Identifiers: *Sam Rayburn Reservoir (Tex), *Angelina River (Tex), Angelina County (Tex), Jasper County (Tex).

The Sam Rayburn Reservoir study area in Texas, on the Angelina River, extends from Lufkin, Angelina County, to Bevelport, Jasper County, a distance of some 60 miles. Tributaries influencing water quality downstream from Lufkin include Bayou La Nana and Paper Mill Creek. About 4 cfs of treated municipal wastes is discharged into Bayou La Nana, while Paper Mill Creek receives some 30 cfs. The Angelina River seldom contains more than 400 mg/liter of dissolved solids. Thermal stratification studies show that the water in the reservoir begins to stratify in March and ceases in November. During December through February stratification is practically nonexistent. At most sites studied the dissolved oxygen gradient was large during the summer stagnation period and decreased greatly during winter circulation periods. The concentration of dissolved solids varies from 100 to 145 mg/liter and was variable during the first year of impoundment. Concentrations of iron and manganese near the dam site were less than 0.40 and 0.25 mg/liter, respectively. During summer stagnation these concentrations increased, especially below the thermocline. General water quality changes downstream from the dam site are small. (Glasby-USGS)
W71-13854

SALINE LAKES OF THE EASTERN PAMIRS AS CONCENTRATORS OF RARE ELEMENTS (Solyanyye ozera Vostochnogo Pamira--kontsentratory redkikh elementov),
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
S. R. Kraynov, N. G. Petrova, and I. V. Baturinskaya.
Akademiya Nauk SSSR Doklady, Vol 198, No 4, p 940-943, 1971. 1 fig, 2 tab, 7 ref.

Descriptors: *Geochemistry, *Saline lakes, *Saline water, Salinity, Salts, Boron, Molybdenum, Titanium, Groundwater, Surface waters, Connate water, Brines, Metamorphic rocks, Granites.
Identifiers: *USSR, *Rare elements, Pamirs, Lithium, Rubidium, Arsenic, Bromine, Iodine, Mineralization.

The lakes of the Eastern Pamirs are rich in many rare elements, including Li, Rb, B, Ti, As, Mo, Br, and I. The waters of these lakes are brines of the Cl-CO3 (HC03)-SO4-Na type with a mineralization of 100 g/liter or more and with a pH of 10. The rare element concentrations, which were particularly high for Li, Ti, As, W, and Br, were determined from the ratios of their content in the lake waters (percent, recalculated to 1 kg of water) to their average content in granitoid rocks. The approximate modes of occurrence of the rare elements in lake waters were determined from the modes of migration of a number of rare elements in alkaline waters. Three groups of rare elements were identified: (1) the cationogenic elements (Li, Rb); (2) the complexing elements (Nb, Ti); and (3) the anionogenic elements (W, Mo, As, B, Br, I). The degree of element concentration in the lake waters was highest for the anionogenic elements (particularly Br, I, As, and W) and lowest for the complexing elements. Granites and metamorphic rocks with near-Clarke concentrations in most of the rare elements examined are the source of the rare elements for lake waters. The supply of rare elements to lakes is associated both with surface- and groundwaters and with deep-seated joint-vein (interstitial) waters. (Josefson-USGS)
W71-13866

WATER QUALITY INVESTIGATION, PART II-BASIC DATA, FORT LOUDOUN RESERVOIR, JUNE 1968-DECEMBER 1970.
Tennessee Univ., Knoxville. Water Resources Research Center.

Tennessee University, Water Resources Research Center Technical Bulletin No 2, June 1971. 103 p, 1 fig, 3 tab, 4 ref. OWRR Projects A-013-TENN (1) and A-006-TENN (8).

Descriptors: *Water quality, *Water analysis, *Reservoirs, *Tennessee, *Hydrologic data, Chemical analysis, Data collections, Water chemistry, Surface waters, Sampling, Analytical techniques, Surveys.
Identifiers: *Fort Loudoun Reservoir (Tenn).

Water quality data are presented for Fort Loudoun Reservoir, Tennessee for the period June 1968 to December 1970. Fort Loudoun Reservoir on the Tennessee River extends from a dam at Tennessee River Mile 602.3 approximately 55 miles to 5.2 miles above the junction (Mile 652.1) of the French Broad and Holston Rivers. Ther Reservoir has a shore length of approximately 360 miles and a total storage area of 386,500 acre-feet. Samples were collected from 11 sites at specified depths using a hose connected to a pump located in the boat. On each sampling date three separate samples were taken at each station. The specified depths in the reservoir cross-section were at the surface, at mid-depth, and at the bottom at the center line of the reservoir. Dissolved oxygen and temperature were measured in a closed chamber connected to the pump discharge and samples for subsequent laboratory analysis were obtained from the overflow from this chamber. (Woodard-USGS)
W71-13908

2I. Water in Plants

METHODS OF HYDROBIOLOGY (FRESHWATER BIOLOGY),
Jurgen Schwoerbel.
200 p, Illus, Pergamon Press Inc.: Elmsford, N.Y., 1970. Pr. $8.00.
Identifiers: Algae, Apparatus, Biology, Biomass, Book, Fresh, Hydrobiology, Insects, Methods, Phyto, Plankton, Populations, Water, Zoo.

This book is concerned with the specific hydrobiological methods and techniques used for the study of standing and flowing waters in relation to the free water and bottom zones, particularly those used which make qualitative and quantitative collections of aquatic organisms possible. The various forms of apparatus required and their use, the methods used for capturing organisms and taking samples and the evaluation of the results are all described in detail. The techniques for dealing with plankton and bottom organisms, with plants and animals which are either attached or float freely are surveyed in such a manner that the experienced worker can easily refer to them while at the same time the student is given an introduction to them. In addition to the purely biological methods, physical and chemical methods for the investigation of water are also considered. The methods or marine biology are not considered in the volume, although some of the methods of measurement and calculation used by production biology are included. After an introduction to the community life, total life and levels of correlation in water as an environment for organisms, the 1st chapter deals with the determination of elements in water to enable the hydrobiologist to make a rapid estimate of it as an environment of organisms. Methods are given then for the investigation of zooplankton, phytoplankton, of the eulittoral zone, infralittoral zone and profundal zone and banthal region. For environments of running water, determination techniques are covered for plant populations, animals, plankton and insects. Phreatic fauna (in underground water) is discussed, followed by methods for the determination of the biomass, primary production and consumption in water and the population dynamics of the zooplankton. A final chapter deals with ecological methods and physiological considerations for biological studies of water quality. Appended are methods of fixation and preservation of specimens, culture methods for algae and firms which make hydrobiological apparatus.--Copyright 1971, Biological Abstracts, Inc.
W71-13101

SMALL FRESHWATER ORGANISMS ON ENIWETOK ATOLL,
Texas Univ., Austin. Dept. of Zoology.
Bassett Maquire, Jr.
Micronesica. 3 (2): 151-157, 1967.
Identifiers: Atoll, Central, Eniwetok, Fresh, Ocean, Organisms, Pacific, Variety, Water.

Eniwetok Atoll is near the north end of the Marshall Islands in the central Pacific Ocean. A study was made during the summer of the 1963 to determine the existence and characteristics of a microscopic freshwater biota which might live in small, sporadically existing temporary bodies of fresh water on a very isolated atoll which lacks fresh surface water. Collections of fresh water were made on 4 different islets of Eniwetok. The number of different kinds of small freshwater organisms, in view of the great isolation of the atoll and the general lack of fresh water was astounding. There were at least 81. Many that were found are able to live as part of the soil biota as well as in standing water. It was evident that a large number of the organisms found in fresh water on Eniwetok were transported to the atoll and were not merely adaptable but normally marine species. Transport of some small aquatic organisms to Eniwetok may have resulted from the activities of the Micronesians or the Japanese or Americans during and after World War 2.--Copyright 1971, Biological Abstracts, Inc.
W71-13106

THE BOTTOM FAUNA OF THE RAPIDS OF THE BLACK VOLTA RIVER IN GHANA,
Makerere Univ., Kampala (Uganda). Dept. of Zoology.
T. Petr.
Hydrobiologia. 36 (3/4): 399-418, Illus, Map, 1970.
Identifiers: Bark, Black, Bottom, Cheumatopsyche, Climatic, Cricotopus, Crop, Distribution, Ec-

nomus, Fauna, Ghana, Habitat, Larvae, Rapids, River, Standing, Volta.

The increase in abundance and biomass of the bottom fauna in the Black Volta River rapids seems to be closely related to increasing rate of water flow. These differences are due mainly to the increasing number of Cheumatopsyche larvae, a web spinning caddisfly. At higher current speeds more food is provided for this omnivorous species, and this seems to determine its density on the substratum. In a very slow current which prevents the use of webs for food catching, this genus is absent. The abundance and standing crop of bottom fauna at the end of dry season can be considered as the highest for the whole year. The presence of several instars of the commonest species guarantees almost continuous emergence and recolonization of the substratum during the dry season. With the onset of heavy rains and floods the communities found in the rapids are disturbed, and eventually completely destroyed. This is because the substrate is carried away by the swift flow of the river. Recolonization can be expected after the rains when the water level is low and the substratum again stabilized. The fauna of rapids is a community which can be expected to be almost completely destroyed when it becomes permanently flooded in any man-made lake. Some organisms, however, such as the larvae of Ecnomus and Cricotopus may establish themselves again in a habitat physically and chemically akin to that of rapids; such a habitat is for example the bark of flooded trees exposed to wave action and surrounded water well saturated with O2.--Copyright 1971, Biological Abstracts, Inc.
W71-13108

CHEMICAL CHANGES INVOLVING NITROGEN METABOLISM IN WATER AND PARTICULATE MATTER DURING PRIMARY PRODUCTION EXPERIMENTS,
Ceskoslovenska Akademie Ved, Prague. Hydrobiologicka Lab.
L. Prochazkova, P. Blazka, and M. Kralova.
Limnol Oceanogr. 15 (5): 797-807, Illus, 1971.
Identifiers: Chemical, Matter, Metabolism, Nitrogen, Particulate, Photosynthesis, Primary, Production, Water.

The uptake of ammonia and nitrate by particulate matter during photosynthesis in large light and dark bottles was followed by colorimetric and mass spectrometric methods. Ammonia uptake as determined by the 15N isotope was always higher than the parallel estimate from colorimetric analysis. The uptake (or release) of ammonia in the dark was inversely related to the protein content of the corresponding sample of particulate matter. Utilization of nitrate in light was inversely proportional to the concentration of ammonia available. The particulate organic matter contained 50.5% protein in light bottles but 61.7% protein in dark ones. The mean ration of O2 changes, as calculated from changes in protein, carbohydrate, and lipid to those found experimentally, was 1.03 in light bottles (indicating good agreement) and -0.34 in dark ones. This is interpreted as evidence for some particle formation in the dark that is probably not microbial.--Copyright 1971, Biological Abstracts, Inc.
W71-13118

GERMINATION ECOLOGY AND ADAPTATION TO HABITAT TO LEAVENWORTHIA SPP. RUCIFERAE),
Bot. Dep., Univ. Ky., Lexington, Ky., Kentucky Univ., Lexington. Dept. of Botany.
Jerry M. Baskin, and Carol C. Baskin.
Amer Midland Natur. 85 (1): 22-36. 1971.
Identifiers: Adaptation, Aridity, Cruciferae-D, Ecology, Germination, Habitat, Leavenworthia-D-Spp, Leavenworthia-Stylosa-D, Leavenworthia-Torulosa-D, Leavenworthia-Uniflora-D, Moisture, Ripening, Seasonal, Temperature.

Leavenworthia stylosa Gray, L. uniflora (Michx.) Britt., and L. torulosa Gray are winter annuals that grow in shallow rocky soils of middle Tennessee cedar glades. Seeds of these species are dispersed in May, but germination is delayed until Sept. and Oct. This study investigates reasons for the failure of these winter annuals to germinate during the summer. At maturity, practically all of the seeds are dormant, and germination during late spring and early summer (May and June) apparently is prevented by an internal dormancy mechanism (s). Dormancy in many of the seeds is overcome by a short period of after-ripening so that, in nature, a certain percentage of the seeds are nondormant (but quiescent) during July and Aug. During the quiescent period, nondormant seeds will germinate at constant temperatures ranging from 10 to 20 C but not at higher constant temperatures or at alternating temperatures that occur in nature during this time, even if the soil is kept continuously moist. By autumn most of the seeds have after-ripened and with the arrival of lower autumn temperatures, seeds germinate as soon as moisture conditions permit. The after-ripening requirement and the relatively low temperature requirement for germination insure that germination does not occur during the summer. These germination-regulating mechanisms can be interpreted as ecological adaptations to the seasonally-arid glade habitat.--Copyright 1971, Biological Abstracts, Inc.
W71-13127

THE VEGETATIVE MORPHOLOGY, HABITAT PREFERENCE AND WATER BALANCE MECHANISM OF THE BROMELIAD TILLANDSIA IONANTHA PLANCH,
Oberlin Coll., Ohio.
David H. Benzig, and Christopher E. Dahle.
Amer Midland Natur. 85 (1): 11-21. 1971.
Identifiers: Balance, Bromeliad, Deficit, Foliar, Habitat, Mechanism, Mineral, Morphology, Preference, Tillandsia-Ionantha-M, Trichome, Uptake, Vegetative, Water.

T. ionantha Planch is a Mexican and Central American epiphyte or saxicole. Because this species cannot impound water and debris among overlapping leaf bases as do many other bromeliad epiphytes and because it lacks a root system capable of significant absorption, it must rely on rapid mineral and water uptake over the shoot surface. Adaptations which permit this plant to succeed in dry, exposed habitats are a capacity for water uptake through foliar trichomes, the capacity to resist rapid drying at low humidities, and the ability to endure extreme desiccation without incurring irreversible impairment of its metabolism. It is not as insensitive to desiccation injury as some true poikilohydrous plants. When water deficits approach 75-80%, irreversible metabolic injury occurs as evidenced by permanent impariment of photosynthesis and respiration and eventual death. Young seedlings are less capable of resisting desiccation than adult rosettes but they can endure at least a 65% water deficit without loss of function.--Copyright 1971, Biological Abstracts, Inc.
W71-13129

OBSERVATIONS ON VEGETATION PATTERNS AND DYNAMICS ON HAWAIIAN AND GALAPAGEIAN VOLCANOES,
Smithson Institute, Washington, D.C.
F. R. Fosberg.
Micronesica. 3 (2): 129-134. 1967.
Identifiers: Acacia-D, Altitude, Climate, Dynamics, Galapageian, Hawaiian, Lava, Metrosideros-D, Moisture, Patterns, Vegetation, Volcanoes.

The major vegetation patterns in the Hawaiian and Galapagos islands seem to be controlled by elevation and the consequent climatic patterns. They correspond very well with the prevailing moisture patterns. New lava and ash substrata favor at least facultative xerophytes because of extreme drainage and high temperatures. Two tree genera, Metrosideros and Acacia, both strongly xeromorphic in morphology, are dominant in Hawaiian hygrophilous forests. The most obvious vegetation feature controlled by volcanism is the 'kipuka' phenomenon, which is an 'island' of vegetation surrounded and isolated by lava flows.--Copyright 1971, Biological Abstracts, Inc.
W71-13131

THE BENTHIC ALGAL COMMUNITIES OF A NORTH CAROLINA PIEDMONT STREAM,
Dep. Biol., West. Ky. Univ., Bowling Green, Ky. Western Kentucky Univ., Bowling Green. Dept. of Biology.
Gary E. Dillard.
Nova Hedwigia. 17 (1-4): 9-29. 1969.
Identifiers: Achnanthes-Minutissima, Algal, Benthic, Communities, Dominance, Eunotia-Pectinalis-Var-Minor, Gomphonema-Parvulum, North-Carolina, Piedmont, Seasonal, Stream, Temperature, USA, Water.

Regularly visited study stations were established along the courses of various streams of the Barton Creek system in Wake County, North Carolina, in order to study the benthic algal communities present, accumulate quantitative data on the macroscopic forms as well as the microscopic, epilithic forms occurring in the stream system, and correlate changes in seasonal periodicity with respect to changes in water temperature, light, and current velocity. Several benthic algal communities were named on the basis of their permanence within the stream or consistent seasonal recurrence while maintaining an identity of species composition and microhabitat. Water temperature was the primary factor in the initiation of changes in seasonal dominance. Increase or decrease of water temperature above or below 15 C, seems to be of critical importance to numerous species. On the basis of simplicity and repeatability, the use of planted glass slides to acquire quantitative and qualitative data on the epilithic communities was found to be superior to styrofoam or direct sampling from natural substrata. Due to its simplicity, the glass slide technique can be repeated exactly from stream to stream. Thus, it provides a good relative measurement for comparative purposes. Eunotia pectinalis var. minor was the pioneer organism of the permanent epilithic diatom community although not dominant in the mature community. Achnanthes minutissima and Gomphoema parvuulum (vars. parvuulum and subellipticum) were co-dominants in the Barton Creek system. No successional phenomena among the benthic algal communities were observed. Unless one removes the factors of time and succession from the climax concept as applied in terrestrial plant ecology, it is not applicable to algal communities of streams. Benthic algal communities of streams become stabilized but are typically of short seasonal duration even though they recur year after year.--Copyright 1971, Biological Abstracts, Inc.
W71-13132

BIOLOGICAL STUDY OF THE EUTERPE OLERACEA SWAMPS OF FRENCH GUIANA,
Office de la Recherche Scientific et Technique Outre-Mer, Cayenne (French Guiana). Centre ORSTOM de Cayenne.
R. A. A. Oldeman.
Cah O R S T O M (Office Rech Sci Tech Outre-Mer Ser Biol. 10. 3-18. Illus. 1969. (Engl. and Span. summ.)).
Identifiers: Biological, Euterpe-Oleracea-M, Exploitation, French-Guiana, Ground, Heart, Palm-M, Pneumatophores, Swamps, Virola-Surinamensis-D, Water.

Euterpe oleracea Mart., a palm, may dominate the vegetation of certain swamps with a well-defined mean level and yearly amplitude of ground-water, and accumulations of pegasse. E. oleracea should be considered as a branched palm with basitonic ramification: it forms pneumatophores. Sometimes, it occurs in pure stands, but mostly it is mixed with other species, such as Virola surinamensis. Exploitation of E. oleracea could yield sufficient raw material for a modest palm-heart industry, but methods should be adapted to conditions in French Guiana.--Copyright 1971, Biological Abstracts, Inc.

W71-13133

ALTITUDE DIFFERENTIATION OF PODOLIA VEGETATION,
Akademiya Nauk URSR, Kiev. Instytut Botaniki.
Y. R. Shelyah-Sosonko.
Ukr Bot Zh. 27 (4): 523-525. 1970. (Engl. summ.).
Identifiers: Altitude, Beech-D, Climate, Differentiation, Hornbeam-D, Moisture, Oak-D, Pine-G, Podolia, USSR, Vegetation.

The bands occur downwards in the following sequence: beech forests, oak-hornbeam forests, oak-pine forests and pine forest. Climatic and moisture factors are important.--Copyright 1971, Biological Abstracts, Inc.
W71-13135

THE FORMATION OF PLANT AGGREGATIONS ON THE ASH TIP OF THE SOUTH KUZBASSK STATE REGIONAL ELECTRIC POWER PLANT IN DIFFERENT EXPERIMENTAL VARIANTS,
M. V. Khamidulina.
Uch Zap Ural Univ. 94. 78-95. 1970. (Translated from Ref Zh Biol, 1970, No. 9V559.).
Identifiers: Aggregations, Ash, Clover-D, Coal, Colonization, Coltsfoot-D, Electric, Fertilizer, Formation, Horse, Kuzbassk, Plant, Power, Seed, Sorrel-D, South, Sow, Thistle-D, Tip, USSR, Variants, White.

Coal ashes contain a great deal of Al2O5 (29%) and SiO2 (64%) and 25 macro and trace elements. In its mechanical composition the ash corresponds to light loams. The source of seeds to populate the ash tip is the vegetation of the dam, and the populating action proceeds most intensively along the inner edge of the dam. On the ash tip the pioneer plants appear 5-10 yr after use has stopped. The vegetation appears primarily where the seeds can hang on. The marginal strip next to the dam grows most vigorously. From 4-7 spp./m2 are noted. There is gradual formation of aggregations of coltsfoot, horse sorrel, and field sowthistle, and unmixed populations of white clover. The larger areas are occupied by Compositae. When the ash substrate is covered by 2 cm of soil or fertilizer, the change in species saturation proceeds very rapidly: the species composition achieves maximum variety from the very 1st years. Woody vegetation appears in the 10th-11th yr after the ash tip is no longer used. On the ash tip at the South Kuzbassk State Regional Electric Power Plant an indefinite type of formation of phytocoenoses was noted; both annuals and perennials were involved.--Copyright 1971, Biological Abstracts, Inc.
W71-13136

THE VEGETATION OF THE ONON RIVER VALLEY (IN THE SOUTHEASTERN TRANSBAIKAL),
For primary bibliographic entry see Field 04A.
W71-13137

THE VEGETATION OF THE AINOVY ISLANDS,
For primary bibliographic entry see Field 02C.
W71-13138

THE ROLES OF SPARTINA SPECIES IN NEW ZEALAND,
Department of Agriculture, Mosgiel (New Zealand). Invermay Agricultural Research Center.
For primary bibliographic entry see Field 04A.
W71-13139

THE ZOOPLANKTON OF SOME TRIBUTARIES OF THE IRTYSH RIVER,
G. S. Ivan'kova.
Nauch Tr Omsk Med Inst. 95. 51-55. 1969. (Translated from Ref Zh Biol, 1970, No. 9U94.)
Identifiers: Cladocerans, Copepods, Irtysh, Plankton, River, Rotifers, Tributaries, USSR, Zoo.

Studies were made of the zooplankton of 4 tributaries of the Irtysh River (the Ishim, Tobol, Om', and Ui). It consisted of 21 spp. of rotifers and 10 of cladocerans and of naupliuses and copepodites of copepods. According to sediment samples, the summer zooplankton population size in the Tobol was 2.5 million individuals per m3 and in the Ishim 3.5 million. Rotifers were most numerous. The waters of the Ishim at the town of Tselinograd and of the Tobol at Kustanai are of the micro-mesosaprobic type. The waters of the Om' and the Uya contain considerable amounts of humins. Zooplankton population size of the Ui River, according to sediment samples, in July was 100,000 individuals/m3 and, in the Om' River (according to netted samples) 1000/m3.--Copyright 1971, Biological Abstracts, Inc.
W71-13141

HYDROLOGIC RESPONSE OF A YOUNG PINE PLANTATION TO WEED REMOVAL,
Georgia Univ., Athens. School of Forest Resources.
For primary bibliographic entry see Field 03B.
W71-13286

FOREST SPECIES AS INDICATORS OF FLOODING IN THE LOWER WHITE RIVER VALLEY, ARKANSAS,
Geological Survey, Little Rock, Ark.
M. S. Bedinger.
GPO. Washington, D.C. 20402-Price $2.75. Geological Survey Research 1971, Chapter C, Professional Paper 750-C, p C248-C253, 1971. 2 fig, 2 tab, 7 ref.

Descriptors: *Forests, *Floods, *Terraces (Geological), *Flood plains, *Arkansas, Geomorphology, Vegetation effects, Distribution patterns, Ecological distribution, Environmental effects, Hydrology, Bioindicators.
Identifiers: Forest-flooding relations.

The dominant environmental factor of forest habitats within the lower valley of the White River, Ark., is flooding. The flood plain consists of a series of terraces. Distribution of forest species on the terrace levels is related to flooding. The relationship is sufficiently distinct to permit determination of flood characteristics at a given site be evaluation of forest-species composition. The vegetation of the lower White River valley can be divided into four groups. Each group occurs on sites having distinctly different flooding characteristics. On sites flooded 29-40 percent of the time, the dominant species are water hickory and overcup oak. On sites flooded 10-21 percent of the time, a more varied flora exists--including nuttall oak, willow oak, sweetgum, southern hackberry, and American elm. The third group of sites is subject to flooding at intervals of from 2 to 8 years. This group is marked by presence of southern red oak, shagbark oak, and black gum. The presence of blackjack oak marks the fourth group (not flooded in historic times). (Knapp-USGS)
W71-13469

ISOTOPIC COMPOSITION OF SULFUR IN PLANTS AND ANIMALS OF WATER BODIES OF VARYING SALINITY (Izotopnyy sostav sery rasteniy i zhivotnykh iz vodoyemov razlichnoy solenosti),
Vsesoyuznyi Nauchno-Issledovatelskii Geologo-Razvedochnyi Neftyanoi Institut, Moscow (USSR).
V. L. Mekhtiyeva.
Geokhimiya, No 6, p 725-730, June 1971. 3 tab, 6 ref.

Descriptors: *Geochemistry, *Sulfur, *Aquatic plants, *Aquatic animals, *Radioisotopes, Bodies of water, Reserviors, Sea water, Salinity, Sulfates, Aquatic algae, Plankton, Plant tissues, Flowering, Spectroscopy, Analytical techniques.
Identifiers: *USSR, *Isotopes, White Sea, Black Sea, Caspian Sea, Indian Ocean, Rublevo Reservoir, Isotopic composition, Spectrum analysis.

The content and isotopic composition of sulfur in plantsof the White Sea and in animals of the Rublevo Reservoir, White, Black and Caspian Seas, and the Indian Ocean were examined. The total sulfur content in plant tissues varies between 0.54 and 4.99% of absolutely dry weight. The average content of sulfur in plants of the Rublevo Reservoir is 1.09% and that in plants of the Black and White Seas, 2.38 and 2.03%, respectively. The average sulfur content in marine flowering plants is 0.74%, which is lower than that in algae. The isotopic composition of sulfur in plant tissues is similar to that of sulfate in sea water, although slightly (2.3%) richer in S32. The total sulfur content in animal tissues is considerably lower than that in plants and varies between 0.1 and 3.32%. Its isotopic composition is, on the average, 3.6% richer in S32 than that of sulfate in sea water. (Josefson-USGS)
W71-13498

ANNUAL REPORT, 1970-1971.
Arizona Univ., Tucson. Environmental Research Lab; and Arid Lands Research Center, Abu Dhabi (Trucial Oman).

Descriptors: *Arid lands, *Horticulture, *Industrial crops, *Growth chambers, *Vegetable crops, Desalination, Irrigation, Humid areas, Research and development, Plant breeding, Plant physiology, Greenhouses, Materials engineering, Management, Training, Environment, *Arizona.
Identifiers: *Abu Dhabi.

The Environmental Research Laboratory of the University of Arizona is dedicated to the proposition that the most promising method of crop production in arid lands is within controlled-environment greenhouses which utilize the one nonlimiting factor in deserts, sunlight. This has led to the development in the Laboratory, of integrated power/water/food facilities for coastal desert regions. These are air-inflated plastic greenhouses linked to diesel power generators. Waste heat from the generators is utilized to desalt seawater, which is then used to irrigate crops within the greenhouses. Crop yields may be further increased by enriching the enclosures with carbon dioxide, also taken from the generators. Construction of such a facility is nearing completion in the Arabian Peninsula nation of Abu Dhabi. With the aim of permitting large-scale vegetable production on an otherwise barren island, the goal is about 3,000 lbs. per day from 5 acres by 1971. Meanwhile, supportive investigations and basic research are continuing at the Laboratory headquarters in Tucson and at a coastal research laboratory in Mexico. The various projects and their progress during the past year are described in detail. (Casey-Arizona)
W71-13569

THE INFLUENCE OF VEGETATION IN SOUTH AFRICAN MOUNTAIN CATCHMENTS ON WATER SUPPLIES,
Stellenbosch Univ. (South Africa); and Department of Forestry, Stellenbosch (South Africa).
For primary bibliographic entry see Field 03B.
W71-13575

PATTERNS OF DISTRIBUTION OF SOME XEROPHYTIC SPECIES IN THE NEGEV, ISRAEL,
Tel-Aviv Univ. (Israel). Dept. of Botany.
Y. Waisel.
Israel Journal of Botany, Vol 20, No 2, p 101-110, 1971. 2 fig, 4 tab, 15 ref.

Descriptors: *Xerophytes, *Ecological distribution, *Plant populations, *Arid lands, *Statistical methods, On-site investigations, Rainfall, Habitats, Ecology, Climatic data, Environmental effects, Mode of action.
Identifiers: *Negev Desert.

The major forms of plant distribution (random, uniform and patchy) are reviewed and discussed.

Analyses of distributions of dominant desert plants are important not only because of insights into plant requirements and interrelationships but also such distributions may serve as climatological indicators and give narrow ranges of ecological information for certain little-studied habitats. Patterns of plant distribution were studied in variants of a Zygophyllum dumosa community along a climatological transect ranging from 100 mm mean annual rainfall to 60 mm. On the more humid sites, distribution patterns of Z. dumosa were random, indicating optimal environmental factors and excluding intraspecific competition as a controlling factor. The aggregated patterns of other species in the same area seemed to be largely caused by their modes of reproduction. At 80 mm rainfall the Z. dumosa distribution patterns became random, indicating that intraspecific competition becomes important. On the most xeric sites, distribution became patchy, since the species could grow only in isolated favorable microhabitats. Although the distribution pattern is affected by several environmental factors, it may still help in obtaining estimates of the water region of various desert habitats. (Casey-Arizona)
W71-13576

CYCLIC SALT AND PLANT HEALTH,
Department of Primary Industries, Brisbane (Australia).
N. G. Cassidy.
Endeavor, Vol 30, No 110, p 82-86, May 1971. 2 fig, 5 tab, 16 ref.

Descriptors: *Salinity, *Chlorides, *Aerosols, *Stomata, *Rainfall, Crop response, Leaves, Plant pathology, Vegetation effects, Sodium, Chemical analysis.
Identifiers: *Atmospheric salinity, *Cyclic salt, *Salinity shadows.

A salt which undergoes the process of atmospheric uptake from the ocean followed by eventual return to the ocean by rainfall and drainage is termed a cyclic salt. Because they are colloids, such salts form aerosols. They are removed from the atmosphere by rainfall and by collision with plants, buildings, etc. When rain is encountered by an aerosol cloud, a selective ion removal results with Na, Mg, and Cl predominating in the hygroscopic fraction, which then settles faster through the air. Collector strips and rainfall analysis show good agreement for general levels of Cl aerosols. However, because rainfall periods are brief, rainfall analysis cannot provide an absolute measure of the rate at which Cl is being added to a particular area. During the non-rain periods, the aerosol is active in bringing Cl to ground level, and there is evidence that in certain areas, aerosols are 1000 times more important than rainfall. When relative humidity exceeds 75%, aerosol particles become liquid, facilitating their removal from the atmosphere by contact with vegetation surfaces. The fact that leaf stomata are 10 times larger than colloidal particles means that stomata provide free entry into a plant. Folier and root uptakes of Cl provide the apparent agricultural paradox that in certain areas, salt problems can occur despite high rainfall. This is illustrated in the case of rice 'yellows', a diseased condition of rice leaves which results from high foliar uptake of Cl following leaf cuticle damage by leafhoppers. There is also evidence that this mechanism is responsible for several coconut diseases. (Casey-Arizona)
W71-13582

TRANSPIRATION IN THREE EUCALYPTUS SPECIES AS A FUNCTION OF SOLAR ENERGY, SOIL MOISTURE AND LEAF AREA,
Volcani Inst. of Agricultural Research, Rehovoth (Israel).
For primary bibliographic entry see Field 02D.
W71-13589

LEAF TEMPERATURE EFFECTS ON MEASUREMENTS OF DIFFUSIVE RESISTANCE TO WATER VAPOR TRANSFER,
Stanford Univ., Calif. Dept. of Biological Sciences; and Australian National Univ. Canberra. Research School of Biological Sciences.
P. A. Morrow and R. O. Slatyer.
Plant Physiology, Vol 47, No 4, p 559-561, April 1971. 3 fig, 9 ref. NSF Grants GB 21441 and GB 8184.

Descriptors: *Leaves, *Air temperature, *Stomata, *Water vapor, *Diffusion, Resistance, Transpiration, Theoretical analysis, Humidity, Instrumentation, Calibration, Flow measurements, Laboratory tests.
Identifiers: *Diffusion parameter.

The diffusion parameter, which has come into widespread use in the past few years, measures the actual diffusive resistance of the leaf to water vapor movement and involves essentially the same transfer processes and pathways as those in natural transpiration. Using the calibration equation which is based on a frequently used transpiration equation, it is shown that calibrational and operational procedures in the use of the instrument assume leaf and cup temperatures must be equal, a condition which is not always obtained, particularly with measurements of sunlit leaves. When leaf temperature (T sub 1) is greater than cup temperature (T sub C), under-estimation of leaf resistance occurs. The effect is minimal at high stomatal resistance and increases strongly toward open-stomatal conditions. The errors may range from 20-50%. This may be corrected by shading the leaf until it is reasonable to assume T sub 1 equals T sub C. Measurements on leaves from Eucalyptus, Atriplex and Arbutos show that the shading procedure does not appear to influence stomatal aperture during the measurement period. (Casey-Arizona)
W71-13594

GEOGRAPHICAL ASPECTS OF BIOLOGICAL PRODUCTIVITY,
Akademiya Nauk SSSR, Leningrad. Botanicheskii Institut; and Akademiya Nauk SSSR, Leningrad. Pochvennyi Institut.
N. I. Bazilevich, L. Y. Rodin, and N. N. Rozov.
Soviet Geography: Review and Translation, Vol 12, No 5, p 293-317, May 1971. 5 fig, 5 tab, 46 ref.

Descriptors: *Biomass, *Productivity, *Plant growth, *Ecological distribution, *Climatic zones, Tropical regions, Arid lands, Forests, Biogeography.

More than 99% of the living matter on Earth is made up of green plants, and the rest of the biosphere is totally dependent on their primary productivity. It is therefore of the greatest importance to obtain estimates of the parameters of phytomass reserve (determined annually) and the annual phytomass production (including both above and below ground production). Using world soil and vegetation maps, these parameters were calculated for 106 types of soil and plant formations, grouped in turn by major thermal belts (polar, boreal, suboreal, subtropical, and tropical) and bioclimatic regions (humid, semiarid and arid) within these thermal belts. Of the total world plant mass, the tropical belt accounts for 56%, followed in turn by the boreal belt (18%), subtropical (12%), subboreal (12%) and polar (less than 1%). Differences in plant mass between belts derive mainly from differences in forest cover. Within each thermal belt there is a decline of both total plant mass and weighted mean unit-area parameters from humid to semiarid and arid bioclimatic regions despite the fact that the arid regions may be greater in area than the humid regions. The geographical regularities of distribution suggest a close relationship to climate. A simple heat-moisture ratio explains many but not all of the regularities. In other words, when heat is sufficiently great, excess moisture will yield greater production, but when heat is inadequate, excess moisture will result in less production. (Casey-Arizona)
W71-13596

THE INFLUENCE OF THE ROOT SYSTEM ON THE RELATIONSHIP BETWEEN THE RATE OF TRANSPIRATION DEPRESSION OF LEAF POTENTIAL,
Aberdeen Univ. (Scotland). Dept. of Botany.
R. Stoker and P. E. Weatherly.
New Phytologist, Vol 70, No 3, p 547-554, May 1971. 3 fig, 18 ref.

Descriptors: *Plant root systems, *Transpiration, *Soil-water-plant relationships, Laboratory tests, Cotton, Flow, Resistance.
Identifiers: *Water potential.

Transpirational flux in plants is directly proportional to water potential drop and inversely proportional to flow resistance, and has therefore been considered analogous to Ohms Law. Recently, however, evidence has accumulated indicating that resistance decreases with increasing water flow. The relationship between transpiration rate and depression of water potential of the leaves was investigated with cotton (Gossypium hirsutum) and sunflower (Helianthus annuus) grown in water culture. Altering environmental conditions in a climatological wind tunnel facilitated regulation of transpiration rates. Using a thermocouple psychrometer, water potential was found to be about 9.0 atm in both species over a transpiration rate of 0.4-2.4 g/sq dm/hr. This value was a plateau after a rise from 5.4-6.0 atm at zero transpiration rate, indicating that, within this range, resistance in the plant declined in proportion to the transpiration rate. The decline was nonlinear, but in plants with killed roots, the relationship was linear, indicating that root resistance was but in plants with killed roots, the relationship was linear, indicating that root resistance was constant and the variable plant resistance was in the roots. The resistance of the dead root system was much lower than that of the living roots at low transpiration rates, but at higher rates, the resistances were about equal. The implications of the findings are discussed. (Casey-Arizona)
W71-13598

DISTRIBUTION OF PLANT COMMUNITIES IN SOUTH-EASTERN MONTANA BADLANDS,
Forest and Range Experiment Station, Ogden, Utah.
R. W. Brown.
American Midland Naturalist, Vol 85, No 2, p 458-477, April 1971. 7 fig, 2 tab, 27 ref.

Descriptors: *Biological communities, *Topography, *Soil types, *Soil water, *Ecological distribution, Ecosystems, Environmental effects, Habitats, Semiarid climates, Geomorphology, Plant populations, Vegetation, Sampling, Montana.
Identifiers: *Badlands.

This work represents the first attempt to quantitatively study the vegetation of the plant communities of southeastern Montana. The vegetation of each community was sampled using a modified form of the line-intercept method and soil samples were collected. The climate ranged from subhumid to semiarid. Abrupt changes in the vegetation were between stands and these appeared to correspond with abrupt soil and physiographic changes. There were 5 shrub-dominated and 2 tree-dominated communities. Substantial variations in soil and topographic characteristics occur within small areas leading to rather steep environmental gradients. (Casey-Arizona)
W71-13599

PROSPECTS FOR COTTONWOOD UTILIZATION IN ARIZONA,
Rocky Mountain Forest and Range Experiment Station, Flagstaff, Ariz.; and Arizona Univ., Tucson. Dept. of Watershed Management.
For primary bibliographic entry see Field 04A.
W71-13600

FUNCTIONS PERFORMED BY ROOTS OF SOME SUBMERGED HYDROPHYTES,
Tel-Aviv Univ. (Israel). Dept. of Botany.

Y. Waisel, and Z. Shapira.
Israel Journal of Botany, Vol 20, No 2, p 69-77, 1971. 4 fig, 2 tab, 15 ref.

Descriptors: *Aquatic plants, *Plant growth substances, *Root systems, Plant physiology, Absorption, Translocation.
Identifiers: *Hydrophytes, *Cytokinins.

Evidence has accumulated that the shoots of hydrophytic plants are able to absorb and translocate water and ions, suggesting that the root systems of such plants are relict and functionless. Using apical roots of 3 species of submerged hydrophytes, Myriophyllum spicatum, Potamogeton perforliatus and P. lucens, grown in water for 8 weeks, plants with roots experimentally excised were compared with normal plans. De-rooted plants quickly became senescent. Using tagged ions (Na, Rb, Cl and P), it was shown that, on a weight basis, shoots absorb ions at a higher rate than roots. Bleeding sap was collected from excised roots and bioassayed for cytokinins. Active materials were found at a concentration equivalent to 0.01-0.1 ppm kinetin. Leaves of kinetin-treated plants remained green and their senescence was delayed. Even though root systems of hydrophytes constitute only 1-3% of the plant biomass as compared with 30% in terrestrial plants, it appears that they are nevertheless indispensable to the plant because of their cytokinin-supplying function. (Casey-Arizona)
W71-13601

EFFECTS OF MOISTURE STRESS ON THE MULTIPLICATION AND EXPANSION OF CELLS IN LEAVES OF SUGAR BEET,
California Univ., Berkeley. Dept. of Soils and Plant Nutrition.
N. Terry, L. J. Waldron, and A. Ulrich.
Planta (Berlin), Vol 97, No 4, p 281-289, 1971. 5 fig, 1 tab, 14 ref.

Descriptors: *Osmotic pressure, *Moisture stress, *Plant growth, *Plant physiology, Laboratory tests, Sugar beets.
Identifiers: *Water potential, *Cell division, *Cell volume, *Plant-water relationships.

Relatively few studies have been made on the effects of moisture stress on plant cell division. Sugar beet plants were stressed in alternative ways: (1) by varying culture solution osmotic potentials with polyethylene glycol; and (2) by varying the matric potential at the root surface. A direct measurement of the number of cells in leaves was made and the effects of moisture stress on intact plants grown under well-defined environmental conditions were investigated. Lowering the water potential at the root surface by either method resulted in significant decreases in cell multiplication rates. Cell numbers were 165% greater at a water potential of -372 mb than at -473 mb. When the water potential was decreased by -181 mb, from -15 mb to -196 mb, final cell number was 198% greater at the lower water potential. The mean cell volumes were consistent over all these levels of stress. (Casey-Arizona)
W71-13602

2J. Erosion and Sedimentation

MUDLUMPS AND SUGGESTED GENESIS IN PYRAMID LAKE, NEVADA,
Desert Research Inst., Reno, Nev.
M. D. Mifflin.
In: Hydrology of Deltas, Vol 1, Proceedings of the Bucharest Symposium May 6-14, 1969: International Association of Scientific Hydrology-Unesco Co-edition, p 75-88, 1970. 14 p, 9 fig, 2 ref. (Also published in IASH Publication No 90, 1970.) OWRR Project A-007-NEV (1).

Descriptors: *Deltas, *Sedimentary structures, *Mud, Sedimentation, Groundwater movement, Hydrostatic pressure, Pressure head, Nevada, Lakes.
Identifiers: *Mud lumps, *Pyramid Lake (Nev).

In 1967 mudlumps similar to those of the Mississippi River Delta formed in Pyramid Lake, Nevada, adjacent to a rapidly growing Truckee River delta. Antecedent conditions of stream flow, lake level, and delta growth are known, and geology can be inferred with reasonable accuracy. The structure, distribution, and timing of the mudlumps indicate a direct relation to rapid growth of the delta on offshore muds. A suggested mechanism of formation calls upon greatly increased pore-water pressure in prodelta lacustrine deposits generated by rapid delta growth and the associated rapid loading. Strain culminates as upthrust elongate blocks of mud in the prodelta area when the pore-water pressure exceeds the downward acting overburden pressure. The suggested process requires a number of environmental factors not commonly localized in nature; the rare occurrence of mudlumps may relate to the absence of one or more of the necessary environmental conditions in most deltas. (Knapp-USGS)
W71-13144

SEDIMENT TRANSPORTATION MECHANICS: H. SEDIMENT DISCHARGE FORMULAS.
American Society of Civil Engineers, New York. Task Committee for Preparation of the Sedimentation Manual.
For primary bibliographic entry see Field 08B.
W71-13162

TURBIDITY INSTRUMENTATION: A FIBER-OPTIC SYSTEM FOR MEASURING SEDIMENT CONCENTRATION BY OPTICAL FOURIER TRANSFORMATION,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
For primary bibliographic entry see Field 05A.
W71-13167

USE OF FLUORESCEIN TO MEASURE THE COMPOSITION OF WATERDROP SPLASH,
Agricultural Research Service, Morris, Minn.
For primary bibliographic entry see Field 07B.
W71-13288

INTERSTITIAL SILICA AND pH IN MARINE SEDIMENTS: SOME EFFECTS OF SAMPLING PROCEDURES,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 02L.
W71-13293

CARBONATES IN BLACK SEA BOTTOM SEDIMENTS (Karbonaty v donnykh otlozheniyakh Chernogo morya),
Akademiya Nauk SSSR, Moscow. Geologicheskii Institut.
G. Yu. Butuzova.
Litologiya i Poleznyye Iskopayemyye, No 3, p 18-26, May-June 1971. 3 fig, 29 ref.

Descriptors: *Sedimentation, *Bottom sediments, *Carbonates, Diagenesis, Calcite, Dolomite, Calcium carbonate, Magnesium carbonates, Mollusks, Sea water, Benthic fauna, Mussels, X-ray diffraction, X-ray analysis.
Identifiers: *USSR, *Black Sea, Ooze, Shells, Aragonite, Coccoliths, Coquina, Diffractograms.

Carbonates in recent, ancient and new euxinic Black Sea sediments are characterized by a variety of morphological, mineralogical and genetic forms. Shell materials consisting of aragonite and magnesian calcite are the predominant type of carbonates in shallow-water sediments of the oxygen zone. Carbonates in recent sediments of deep-water zones are represented mainly by clot-like layered accumulations of coccoliths. Coccolith interlayers in ancient Black Sea sediments of deep-water zones are sparsely distributed and are formed principally in the upper horizons of sediments furthest removed from the shore. The mineralogical composition and forms of the carbonates are similar to those in recent sediments. A chemogenic and fragmental calcareous material represented mineralogically by pure calcite and its low magnesian varieties predominates in the deep-sea ooze of the new euxinic layers. Upper Cretaceous and Eocene species of coccolith values are found in small numbers in the suspended river material of the sea basin. (Josefson-USGS)
W71-13298

GEOCHEMICAL EVOLUTION OF THE BLACK SEA IN THE HOLOCENE EPOCH (Geokhimicheskaya evolyutsiya Chernogo morya v golotsene),
Akademiya Nauk SSSR, Moscow. Geologicheskii Institut.
For primary bibliographic entry see Field 02K.
W71-13299

ZIRCONIUM IN RECENT BLACK SEA SEDIMENTS (Tsirkoniy v sovremennykh osadkakh Chernogo morya),
Akademiya Nauk SSSR, Moscow. Institut Okeanologii.
M. A. Glagoleva.
Akademiya Nauk SSSR Doklady, Vol 193, No 1, p 184-187, 1970. 3 fig, 4 tab, 10 ref.

Descriptors: *Sediments, *Bottom sediments, *Chemical analysis, Clays, Mud, Sands, Silts, Particle size, Organic acids, Calcium carbonate, Distribution patterns.
Identifiers: *USSR, *Black Sea, *Zirconium, Pelites, Ooze.

The distribution of zirconium in recent natural and carbonate-free Black Sea sediments was examined. The samples used were collected from the surface sediment layer, from 125 stations distributed uniformly across the sea floor. Zirconium is unevenly distributed in the sediment series: the Zr02 content is maximum in sand (0.0262%), intermediate in silt and clay ooze (0.020-0.0168%) and minimum in calcareous clay ooze (0.0061%). When recalculated to carbon-free matter, the average Zr02 content is greater, although, as before, it is maximum in sand and silt and minimum in carbonate-rich ooze. Recalculation to carbonate-free matter does not essentially alter the pattern of zirconium distribuiton, although it does reveal certain details masked in natural sediment by the high calcium carbonate content. The distribution of zirconium in Black Sea sediments is clearly dependent upon the size of the clastic material being dispersed. The content of zirconium in the sediments increases with grain size. The zirconium content (0.013 to 0.023%) in the finest pelite fraction (less than 0.001 mm) of various Black Sea sediments approximates the average zirconium content of pelites in general. The content of mobile zirconium extractable with weak acidx increases from coarse to fine-grained sediments. Although zirconium may migrate in solution, this form of migration is quantitatively insignificant and too small in comparison with migration in suspension to affect the zirconium distribution in marine sediments. (See also W71-13301) (Josefson-USGS)
W71-13300

ZIRCONIUM IN BLACK SEA SEDIMENTS (Tsirkoniy v osadkakh Chernogo morya),
Akademiya Nauk SSSR, Moscow. Institut Okeanologii.
For primary bibliographic entry see Field 02K.
W71-13301

HOLOCENE CARBONATE ACCUMULATION CONDITIONS IN BELORUSSIAN LAKE BASINS, (Usloviya sovremennogo karbonatonakopleniya v ozernykh basseynakh Belorussii),
Akademiya Navuk BSSR, Minsk. Laboratoriya Geokhimicheskikh Problem.
For primary bibliographic entry see Field 02H.
W71-13304

ZINC IN HOLOCENE BLACK SEA SEDIMENTS (Tsink v sovremennykh chernomorskikh otlozheniyakh),
Akademiya Nauk SSSR, Moxcow. Geologicheskii Institut.
I. V. Belova.
Akademiya Nauk SSSR Doklady, Vol 193, No 2, p 433-436, 1970. 2 fig, 1 tab, 9 ref.

Descriptors: *Geochemistry, *Trace elements, *Bottom sediments, Mud, Clays, Calcium carbonate, Iron, Manganese, Distribution patterns, Maps.
Identifiers: *USSR, *Black Sea, *Zinc, *Ooze, Zinc sulfide, Nickel.

Bottom-sediment samples of Holocene Black Sea deposits were examined to determine the average zinc concentrations in natural sediment and its carbonate-free fraction. The zinc content of the two sediment types is high in clayey and clayey calcareous ooze and slightly lower in calcareous ooze. In natural sediment the zinc background values generally range from 0.005 to 0.01%. The zinc content of natural sediment is governed largely by the diluting effect of calcium carbonate. The distribution of zinc in carbonate-free fraction of sediments differs markedly from that of iron, manganese and nickel and is fundamentally consisten with the type of distribution typical of the most mobile geochemical elements (arsenic and molybdenum). Owing to its considerable geochemical mobility, only a small amount of the zinc is concentrated in coastal regions. Most of the zinc migrates into the pelagic zone of the sea in the form of true solutions, colloidal compounds and finely divided material. (Josefson-USGS)
W71-13305

LEAD IN HOLOCENE BLACK SEA SEDIMENTS (Svinets v sovremennykh osadkakh Chernogo morya),
Akademiya Nauk SSSR, Moscow. Geologicheskii Institut.
I. Yu. Lubchenko.
Akademiya Nauk SSSR Doklady, Vol 193, no 2, p 445-448, 1970. 2 fig, 1 tab, 12 ref.

Descriptors: *Geochemistry, *Sediments, *Trace elements, Calcium carbonate, Mud, Clays, Silts, Physicochemical properties, Distribution patterns, Maps, Hydrodynamics, Spectroscopy.
Identifiers: *USSR, *Black Sea, *Lead, *Ooze, Spectrographs, Spectrograms, Spectral analysis, Coquina.

Samples of Holocene Black Sea sediments were examined for studying the geochemistry of lead in humid-zone deposits. The lead content of the surface-sediment layer ranges from 0.0001 to 0.0103%. In natural sediment the lead content increases from sand to silt and to clayey ooze and decreases in clayey calcareous and calcareous clayey ooze. In the carbonate-free fraction of the sediment the lead content increases continuously from sand to silt to clayey, clayey calcareous, and calcareous clayey ooze. The physicochemical properties of lead govern the forms of its migration. The main form of lead migration in river water is in fine or very fine suspended terrigenous material. Maps showing the distribution of lead in recent Black Sea sediments illustrate the patterns of its localization across the basin. The map for the distribution of lead in the natural sediment is complex. Areas of carbonate-rich ooze coincide with those of both minimum and higher lead values. The map for the distribution of lead in the carbonate-free fraction is even more variegated. Regions of minimum or higher lead values are considerably displaced. Regions of higher or maximum content are displaced into the pelagic zone and the importance of individual basin areas as sources of lead is clearly seen. The hydrodynamics of the Black Sea and the importance of individual coastal areas are quite evident in the distribution of lead in its Holocene sediments. (Josefson-USGS)
W71-13306

TRANSPORT OF CESIUM-137. INTERACTION WITH BED SEDIMENTS,
Texas Univ., Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W71-13386

URBANIZATION AND SEDIMENTATION - A BIBLIOGRAPHY.
Office of Water Resources Research, Washington, D.C. Water Resources Scientific Information Center.

Available from NTIS as PB-203 188, $3.00 in paper copy, $0.95 in microfiche. October 1971. 116 p. WRSIC 71-203.

Descriptors: *Urbanization, *Sediments, *Bibliographies, *Information retrieval, Abstracts, Publications, Erosion, Land use, Programming, languages, Computers, Accelerated erosion, Highway effects, Overland flow, Soil engineering, Construction, Sediment yield, Storm runoff, Water pollution sources, Pollutant identification.
Identifiers: *Urban hydrology, Urban impact, Land use planning.

The bibliography is a compilation of 116 abstracts of current and earlier pertinent reports, journal articles and other publications on urbanization and sediment problems. The abstracts include full bibliographical citations and a set of descriptors from the Water Resources Thesaurus. The bibliography was produced by computer retrieval from the information base of Selected Water Resources Abstracts (SWRA), which had 31,244 abstracts at the time of the retrieval. The KWIC method of indexing is used in which each significant word in the title is filed in alphabetical place. Using a few keywords describing the subject matter of interest, one scans the middle rank for their presence, then the remainder of the title to determine relevance. The bibliography is arranged in ascending WRSIC Accession Number sequence. (Lang-USGS)
W71-13432

HYDROGRAPHY OF SOUTH PASS, MISSISSIPPI RIVER,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02E.
W71-13443

SUBMARINE CANYON EROSION: CONTRIBUTION OF MARINE ROCK BURROWERS,
Rice Univ., Houston, Tex. Dept. of Geology.
J. E. Warme, T. B. Scanland, and N. F. Marshall.
Science, Vol 173, No 4002, p 1127-1129, September 17, 1971. 1 fig, 11 ref. NSF Grant GB 14321, ONR Contract Nonr 2216 (23).

Descriptors: *Erosion, *Marine animals, *Burrows, *Invertebrates, Weathering, Mollusks, Sea water, Canyons, California, Rock properties, Ocean currents, Sediment distribution, Geologic control, Aquatic animals.
Identifiers: *Bioerosion, *Scripps Submarine Canyon (Calif), Bivalve mollusks, Polychaetes, Marine rock burrowers.

Rock samples from Scripps Submarine Canyon, off La Jolla, California, indicate that physical and chemical weathering and erosion are relatively insignificant compared with bioerosion. Discoloration by chemical weathering commonly extends less than 1 cm from surfaces exposed to the sea, and several freshly collected rock samples were completely dry inside when broken open. In contrast, biological penetration extends several decimeters into the rocks. Rocks of the canyon rim and upper walls are intensely burrowed by marine invertebrates and large fragments of fallen rock are bounded by burrows. Important excavators are bivalves, Polychaetes, and sipunculoids whose activities result in a network of passageways and eventual rock disintegration. From the probable life spans of the burrowers and from the high proportion of burrows occupied by live animals, it is estimated that the average attrition of rock surfaces ranges from 2 to 10 mm per year. (Lang-USGS)
W71-13446

COMMENTS ON SPATIAL RANDOMNESS IN DENDRITIC STREAM CHANNEL NETWORKS,
Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.
For primary bibliographic entry see Field 02E.
W71-13453

CHEMICAL WEATHERING AND GLACIAL EROSION OF CRYSTALLINE ROCKS AND THE ORIGIN OF TILL,
T. Feininger.
GPO, Washington, DC 20402 - Price $2.75. Geological Survey Research 1971, Chapter C, Professional Paper 750-C, p C65-C81, 1971. 10 fig, 2 tab, 24 ref.

Descriptors: *Till, *Glacial drift, *Provenance, *Weathering, Glacial soils, Erosion, Soils, Sediments, Sediment transport, Topography, Geomorphology, Glaciers, Soil formation.
Identifiers: *Preglacial weathering.

Prior to Pleistocene glaciation, a virtually uninterrupted mantle of weathered rock overlay crystalline rocks in the Northern Hemisphere. Remnants of this mantle are numerous. Relationships between the topographic surface and the fresh rock surface at the base of the weathered mantle on crystalline rocks in an area with no history of glaciation are used to support the argument that the erosion of crystalline rocks by continental ice sheets is largely limited to the weathered rock mantle. In areas of little local relief, thin till-bedrock topography of glaciated terrains is virtually identical with the fresh rock surface under the weathered rock mantle in nonglaciated terrains. Topography of glaciated and nonglaciated areas of great local relief is very similar. Glacial boulders were present as residual boulders in the weathered rock mantle prior to glaciation and are not evidence of glacial erosion of fresh rock. Till on crystalline rocks is considered to be practically an in situ deposit formed from the weathered rock mantle through flushing by subglacial water concurrent with mechanical churning and only local transport by the overriding ice sheet. Flushing will produce a mineralogically fresher and coarser grained material as it preferentially removes the finer sized fractions of the mantle which include the minerals of decomposition. (Knapp-USGS)
W71-13455

GEOCHEMICAL PROSPECTING FOR THORIUM BY STREAM-SEDIMENT SAMPLING, LEMHI PASS QUADRANGEL, IDAHO AND MONTANA,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02K.
W71-13456

ORIGIN AND SEDIMENTOLOGY OF 1969 DEBRIS FLOWS NEAR GLENDORA, CALIFORNIA,
Geological Survey, Garden Grove, Calif.
K. M. Scott.
GPO. Washington, D.C. 20402-Price $2.75. Geological Survey Research 1971, Chapter C, Professional Paper 750-C, p C242-C247, 1971. 3 fig, 2 tab, 7 ref.

Descriptors: *Mudflows, *Mass wasting, *Floods, *Erosion, *California, Cities, Alluvium, Debris avalanches, Landslides, Urbanization, Sediment transport, Sediment yield, Topography, Slopes, Vegetation effects.
Identifiers: *Glendora (Calif), Urban sedimentation.

Watersheds near Glendora yielded catastrophic volumes of debris slurry during the recordbreaking

1969 storms. Erosion rates sufficient to reduce the entire land surface by more than 2 inches occurred in several of a series of steep mountain-front basins which had suffered brush fires in 1968. The most concentrated damage from debris flows occurred among homes built directly at the mouth of a basin with a drainage area of 0.09 square mile and a relief of 1,400 feet. Triggered in part by surficial slope failures, the debris flows mobilized channel bed material and scoured channels to bedrock. This mechanism is probably the most common means of coarse-sediment transport in these and similar basins. Channel oaks were of considerable value in retaining debris and reducing the number and size of hillslope failures of the type which triggered the flows. (Knapp-USGS)
W71-13468

GEOGRAPHIA POLONICA.
Polish Academy of Sciences, Warsaw. Inst. of Geography.

Geographia Polonica, Vol 17, 1969. 428 p.

Descriptors: *Quaternary period, *Conferences, *Glaciation, Stratigraphy, Sedimentation, Structural geology, Geomorphology, Paleohydrology, Paleoclimatology, Palynology.
Identifiers: *INQUA, Archeology.

This is a collection of papers presented at the 8th International Congress of the International Union for Quaternary Research (INQUA), Paris, 1969. The 29 papers are in the fields of stratigraphy, tectonics, geomorphology, paleohydrology, sedimentation, paleobotany, sedimentology, and archeology. (See also W71-13489 thru W71-13493) (Knapp-USGS)
W71-13488

THE GLACIAL RELIEF OF NORTH POLAND IN THE LIGHT OF THE DETAILED GEOMORPHOLOGICAL MAP OF THE POLISH LOWLAND IN 1:50,000 SCALE,
Polish Academy of Sciences, Warsaw. Inst. of Geography.
For primary bibliographic entry see Field 07C.
W71-13489

SOME REMARKS ON THE ORIGIN OF DRUMLINS,
Wroclaw Univ. (Poland). Inst. of Geography.
S. Baranowski.
In: Geographia Polonica, Vol 17, p 197-208, 1969. 7 fig, 26 ref.

Descriptors: *Glacial drift, *Till, *Geomorphology, *Permafrost, *Frozen ground, Land forming, Scour, Deposition (Sediments), Topography, Glaciation, Sedimentation, Frost, Frost action, Frost heaving.
Identifiers: *Drumlins.

Organized geometry is a characteristic feature of drumlin fields including groups of features similar to drumlins observed at the fronts of some contemporary glaciers. The curve of the frequency distribution of distances between the longer axes of adjacent drumlins in the field has usually a distinct maximum, and very often one or more secondary maxima. These secondary maxima of frequency are usually located at distances which suggest that there exists a preferred wavelength for each field. It is suggested that the formative mechanism of the fluted moraine and drumlins is connected with frost heaving at the glacier bed, modified by the movement of ice. After a long period of basal melting of temperate glaciers with the accumulation of ground moraine and its soaking with water, a cold thermal regime invading the base of the glacier causes progressive freezing of liquid water collected in the ground moraine and in the substratum, and some heaves and bumps form due to increase in volume. These heaves and protuberances spread along the thermal front at fairly even distances which depend on the magnitude of hydrostatic pressure, that is, on the thickness of ice. The heights of the heaves are dependent on the amount of water subjected to freezing. As the thermal front moves, the heaves and protuberances at the glacier bed continuously develop in the direction of movement, forming parallel ridges. The process of the formation of the movement, forming parallel ridges. The process of the formation of the ridges or protuberances lasts until the motion of the thermal front slows or remains at the same rate as the movement of the glacier at its base. (See also W71-13488) (Knapp-USGS).
W71-13490

GENETIC INTERPRETATION OF LITHOLOGICAL FEATURES OF POLISH LOESS,
Marie Curie-Sklodowska Univ., Lublin (Poland). Dept. of Physical Geography.
H. Maruszczak.
In: Geographia Polonica, Vol 17, p 293-310, 1969. 2 tab, 38 ref.

Descriptors: *Loess, *Provenance, *Sedimentation, *Glaciation, *Pleistocene epoch, Glaciers, Weathering, Sediment transport, Mineralogy, Soil formation, Particle size.
Identifiers: *Poland.

The material forming Polish loess shows evidence of its autochthonous origin, especially: (a) morphological grain features similar to those found in periglacial dune, slope and fluvial deposits near loess banks; (b) mineralogical features resembling those of both the glacial deposits and the local substratum. The autochthonous origin of the Polish loess indicates that the material it consists of was mostly derived from local sediments and soils. Preglacial and postglacial processes of transformation and weathering of the mineral material have both played an important part in creating the features the loess shows today. (See also W71-13488) (Knapp-USGS)
W71-13491

POSITION OF BOULDER CLAY AMONG OTHER SEDIMENTARY ENVIRONMENTS BASED ON SOME GRAIN ABRASION PARAMETERS,
Adam Mickiewicz Univ., Poznan (Poland). Inst. of Geography.
B. Krygowski.
In: Geographia Polonica, Vol 17, p 311-318, 1969. 2 fig, 12 ref.

Descriptors: *Till, *Glaciers, *Deposition (Sediments), *Particle size, *Sediment transport, Sedimentation, Clays, Sands, Silts, Histograms, Statistical methods, Sediments.

Histogram analysis of particle-size distributions of glacial tills can be used to estimate the degree of their modification by water. About 22% of boulder clays were deposited dry at the bases of glaciers, with no modification by flowing water. About 63% were modified at the time of deposition by water flowing in cracks and crevasses. The more water-modified the till, the more fractured the glacier must have been. (See also W71-13488) (Knapp-USGS)
W71-13492

SELECTED PROBLEMS OF LITHOLOGY AND PETROGRAPHY OF THE BOULDER CLAYS IN CENTRAL AND EASTERN POLAND,
Geological Inst. Szczecin (Poland). Dept. of Sea-Coast Geology.
R. Racinowski, and J. Rzechowski.
In: Geographia Polonica, Vol 17, p 319-340, 1969. 4 fig, 4 tab, 73 ref.

Descriptors: *Till, *Provenance, *Particle size, *Mineralogy, *Stratigraphy, Pleistocene epoch, Glaciation, Clays, Gravels, Sands, Glaciers, Sediments, Sediment transport.
Identifiers: *Poland.

The relationships between till stratigraphy and mineralogy and the geology of the till's source rock was studied in central and eastern Poland. Petrographical coefficients allow for a correlation of stratigraphical lithotypes even among different regions. The mineral composition as well as the frequency of particles of local rocks in the gravels characterize the regional lithological types and permit accurate definition of the movement of the inland ice. (See also W71-13488) (Knapp-USGS)
W71-13493

CARBON ISOTOPIC COMPOSITION OF ORGANIC MATTER IN BOTTOM SEDIMENTS OF THE MIDDLE CASPIAN SEA REGION (Izotopnyy sostav ugleroda organicheskogo veshchestva donnykh osadkov Srednego Kaspiya),
Institut Neftekhimicheskoi i Gazovoi Promyshlennost, Moscow (USSR).
E. M. Galimov, V. I. Bagirov, and N. G. Kuznetsova.
Geokhimiya, No 6, p 743-746, June 1971. 1 tab, 4 ref.

Descriptors: *Carbon, *Carbon radioisotopes, *Organic matter, *Bottom sediments, *Sedimentation, Stable isotopes, Diagenesis, Mud, Microorganisms, Lipids, Oil, Organic compounds, Stratigraphy.
Identifiers: *USSR, Caspian Sea, Isotopic composition, Bituminoids.

The relative abundance of carbon stable isotopes in organic matter of bottom sediments of the central part of the Caspian Sea was determined to establish a relationship between the isotopic composition of organic carbon and the stratification characteristics of bottom sediments of the region and to trace the evolution of organic matter in the diagenesis of Caspian Sea sediments. Besides measurements of the carbon isotopic composition, determinations were made of (1) the total content of organic carbon in the sediment; (2) the content of fractions extractable with organic solvents--chloroform and alcohol benzene bituminoids; and (3) the number of microorganisms in 1 g of wet mud. The isotopic composition of organic carbon in the sediments studied averages minus 2.36% and occupies a middle position between the organic carbon of marine and continental deposits. A table of the carbon isotopic composition of organic matter reveals its correlation with the stratigraphy of the bottom sediments. (Josefson-USGS)
W71-13499

THE PALEOLIMNOLOGY OF FOUR LAKES IN SOUTH-WESTERN FINLAND,
Helsinki Univ. (Finland). Dept. of Geology and Paleontology.
For primary bibliographic entry see Field 02H.
W71-13503

QUALITY OF SURFACE WATERS OF THE UNITED STATES 1961: PARTS 3 AND 4, OHIO RIVER BASIN AND ST. LAWRENCE RIVER BASIN.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-13512

THE SEA SLED - A DEVICE FOR MEASURING BOTTOM PROFILES IN THE SURF ZONE,
Geological Survey, Menlo Park, Calif.
E. Reimnitz and D. A. Ross.
Marine Geology, Vol 11, No 3, p M27-M32, October 1971. 2 fig, 2 ref.

Descriptors: *Surveys, *Beaches, *Surf, *Equipment, *Profiles, Measurement, Bathymetry, Sounding, Hydrography, Surveying instruments, Mapping, Topography.
Identifiers: *Sea sled, *Beach profiles, *Stadia rods.

The Sea Sled is a simple, easily constructed device for obtaining relatively accurate and quick bottom profiles in the surf zone. The onshore - offshore motion associated with the passage of waves propels the sled on both its seaward traverse and the shoreward return. The Sea Sled is a device which, propelled by wave power, moves along the bottom parallel to wave orthogonals. It can carry equipment, in this case a stadia rod and a line, from the beach seaward through the surf and return to shore. The use of the Sea Sled is restricted to areas in which the sea floor has a relatively smooth sediment cover. Wave conditions under which deep pot-holes develop or under which large, steep ripples form offshore might prohibit the use of even a large sled. (Knapp-USGS)
W71-13606

X-RAY FLUORESCENCE ANALYSIS OF SUSPENDED SEDIMENT IN SEA WATER,
University of East Anglia, Norwich (England). School of Environmental Sciences.
For primary bibliographic entry see Field 02K.
W71-13607

AN ANALYSIS OF SOME FACTORS INVOLVED IN THE DEPTH OF DISTURBANCE OF BEACH SAND BY WAVES,
Hong Kong Univ. Dept of Geography and Geology.
A. T. Williams.
Marine Geology, Vol 11, No 3, p 145-158, October 1971. 4 fig, 5 tab, 22 ref.

Descriptors: *Beach erosion, *Sediment transport, *Surf, *Scour, Tides, Ocean waves, Beaches, Sedimentation, Stratigraphy, Sedimentary structures, Instrumentation, Sands, Particle size.
Identifiers: Beach sands.

A study of the depth of disturbance of beach sand by waves indicates that breaker height is the dominant factor in the mid- and probably low-tide zone; slope is dominant in the higher high-tide zone. No difference was found between erosional depths of fine versus coarse sand. Newly deposited sand was mainly uniform in structure. Dual sedimentation units, if occurring at all, were more common at mid-tide stations and on beaches where there was a greater range of sediment. A method for detecting test areas on the foreshore was based on the principle of a change in frequency when an oscillator passed over a metal plate buried in the beach face. From statistical analysis of over 150 samples, skewness values were found to be typically negative, whereas kurtosis values tended to indicate a difference in modality between the various sedimentation units. Standard deviation figures showed that moderate sorting was typical for bottom units, whereas upper and uniform units seemed to be moderately well sorted. Of the factors causing depth of disturbance of sand at mid-tide position, 82% could be attributed to breaker height, slope and wave period, and at higher high-water mark only 61% of the disturbance was due to these three factors. (Knapp-USGS)
W71-13608

PALEOBATHYMETTIC TRENDS OF NEOGENE FORAMINIFERAL ASSEMBLAGES AND SEA FLOOR TECTONISM IN THE ANDAMAN SEA AREA,
Wyoming Univ., Laramie. Dept. of Geology.
W. E. Frerichs.
Marine Geology, Vol 11, No 3, p 159-173, October 1971. 3 fig, 1 tab, 27 ref.

Descriptors: *Sedimentation, *Marine geology, *Paleohydrology, Structural geology, Stratigraphy, Sediment distribution, Oceanography, Tertiary period, Sampling, Surveys.
Identifiers: *Andaman Sea, *Foraminifera.

Three Miocene and two Pliocene samples recovered from the floor of the Andaman Sea indicate a tectonic history for the sea floor which is similar to the surrounding islands. Benthonic Foraminifera from the Miocene samples indicate that the sediments were deposited in water depths significantly deeper than the depths from which they were dredged. Benthonic Foraminifera in the Pliocene samples, however, indicate depths of deposition similar to the water depths from which they were dredged. The similarity of paleobathymetric histories for the Andaman Sea and surrounding islands suggests that an uplift, probably begining in the Middle Miocene and culminating in the Pliocene, has affected the entire region. Sediment accumulation older than the Miocene, and that the regional uplift may have been initiated at the same time as the sea-floor spreading. (Knapp-USGS)
W71-13609

THE DISTRIBUTION AND MOVEMENT OF SEDIMENT IN THE SOLENT, SOUTHERN ENGLAND,
Southampton Univ. (England). Dept. of Oceanography.
For primary bibliographic entry see Field 02L.
W71-13610

THE INFLUENCE OF SEA LEVEL CHANGES ON SEDIMENT CARBONATE MINERALOGY, TONGUE OF THE OCEAN, BAHAMAS.
Duke Univ., Durham, N.C. Dept. of Geology; and Duke Univ., Durham, N.C. Marine Lab.

Marine Geology, Vol 11, No 3, p 189-200, October 1971. 6 fig, 1 tab, 17 ref.

Descriptors: *Water level fluctuations, *Provenance, *Sediments, *Mineralogy, *Calcium carbonate, Electron microscopy, Sea water, Calcite, Silts, Clays, Sampling, Water chemistry, Carbonates, Sedimentation, Bottom sediments.
Identifiers: *Bahamas, Aragonite.

Large fluctuations occur in the aragonite content of fine silt and clay-sized material sampled by piston cores in Tongue of the Ocean, Bahamas. Electron microscopy reveals that sedimentary sequences with high aragonite content are characterized by abundant aragonite needles. Sedimentary sequences containing small amounts of aragonite but large amounts of low-Mg calcite are dominated by coccoliths. The variation in both mineralogy and grain morphology is interpreted to be related to sea level fluctuations and the consequent presence or absence of sediment contribution (needles) from the adjacent Bahama Banks. These fluctuations are useful chronological indicators in these cores and should be applicable in other areas adjacent to carbonate banks. In particular, the last rise in sea level is clearly marked in all the cores. (Knapp-USGS)
W71-13611

RAPID AND RELIABLE TECHNIQUE FOR DETERMINING UNIT WEIGHT AND POROSITY OF DEEP-SEA SEDIMENTS,
National Oceanic and Atmospheric Administration, Miami, Fla. Marine Geology and Geophysics Lab.
R. H. Bennett, and D. N. Lambert.
Marine Geology, Vol 11, No 3, p 201-207, October 1971. 1 fig, 10 ref.

Descriptors: *Porosity, *Density, *Bottom sediments, Volumetric analysis, Sediments, Bulk density, Laboratory tests, Analytical techniques, Instrumentation.
Identifiers: Deep-sea sediments.

A rapid and reliable technique for determining unit weight and porosity of deep-sea sediment uses water content and average grain density measurements. Comparisons were made between this method and the standard tube method (volumetric), with 77 samples. The correlation coefficient is 0.994 with a standard deviation between the methods of plus or minus 0.01 g/cc. The two techniques when used to determine porosity have a correlation coefficient of 0.998 with a standard deviation of 0.42%. A nomographic chart permits rapid determination of unit weight using water content and average grain density. (Knapp-USGS)
W71-13612

PREDICTION OF FORMATION COMPACTION FROM LABORATORY COMPRESSIBILITY DATA,
Koninklijke-Shell Exploratie en Produktie Laboratorium, Rijswijk (Netherlands).
D. Teeuw.
Society of Petroleum Engineers Journal, Vol 11, No 3, p 263-271, September 1971. 8 fig, 18 ref, 2 append.

Descriptors: *Laboratory tests, *Compaction, *Instrumentation, *Compressibility, Poisson ratio, Permeability, Pressure, Stress, Aquifer characteristics, Porosity, Mechanical properties.
Identifiers: *Aquifer compaction.

A new, simple and inexpensive laboratory testing procedure was developed for simulating realistic reservoir compaction behavior both in cemented and friable rocks. A theoretical expression interrelates uniaxial and hydrostatic compaction, and enables the prediction of the in-situ reservoir compaction from hydrostatic cell compaction data. This relation is verified for various types of rock by comparative measurements in oedometer and hydrostatic cells. Based on these results, a new triaxial cell-type compaction measurement for friable rocks was developed. This method provides an independent evaluation of Poisson's ratio. (Knapp-USGS)
W71-13615

BITUMINOUS SUBSTANCES IN OCEANIC SUSPENDED MATERIAL,
Akademiya Nauk SSSR, Moscow. Institut Okeanologii.
A. P. Listsyn, Yu. A. Bogdanov, L. I. Potapova, and A. N. Maksimov.
Oceanology (USSR), Vol 11, No 1, p 43-54, 1971. 5 fig, 3 tab, 17 ref.

Descriptors: *Bituminous materials, *Sea water, Suspended load, Lipids, Organic matter, Sedimentation, Bottom sediments, Distribution patterns, Oceans, Oceanography, Plankton.

A study of the quantitative distribution, morphology, liminescence, and chemical composition of bitumen-containing particles suspended in sea water reveals that the bulk of such matter is the product of plankton lipids. Suspended bitumens are an intermediate link transmitting the distribution characteristics and composition of plankton bitumens to the surface layer of bottom sediments. (Knapp-USGS)
W71-13619

THE DISTRIBUTION OF RARE-EARTH ELEMENTS IN THE SEDIMENTS OF THE LAGOON ON ILE ST. PAUL,
Akademiya Nauk SSSR, Moscow. Institut Okeanologii.
For primary bibliographic entry see Field 02K.
W71-13620

COASTAL-ZONE GEOLOGY AND ITS RELATIONSHIP TO WATER POLLUTION PROBLEMS,
Barnard Coll., New York. Dept. of Geology and Geography.
For primary bibliographic entry see Field 05B.
W71-13627

EFFECTS OF A DEBRIS SLIDE ON 'SIOUX GLACIER' SOUTH-CENTRAL ALASKA,
North Dakota Univ., Grand Forks. Dept. of Geology.
For primary bibliographic entry see Field 02C.
W71-13644

ON RIVER MEANDERS,
Illinois State Water Survey, Urbana.
C. T. Yang.
Journal of Hydrology, Vol 13, No 3, p 231-253, July 1971. 10 fig, 23 ref. OWRR Grant B-023-ILL (3).

Descriptors: *Alluvial channels, *Meanders, *Channel morphology, Discharge (Water), Sediment load, Sediment transport, Geomorphology, Energy, Flood plains, Regime.

The law of least time rate of energy expenditure is used to explain the formation of meandering streams. This law can explain why stable unbraided channels always follow a smooth sinuous course. It also explains how the variation in water discharge, sediment concentration, channel geometry, channel slope, valley slope and geological constraints should change the characteristics of meandering channels. The arguments are strongly supported by laboratory and field observations. (Knapp-USGS)
W71-13795

THE SIGNIFICANCE OF SEASONAL BEACH CHANGES IN TIDAL BOUNDARIES,
J. W. Johnson.
Shore and Beach, Vol 39, No 1, p 26-31, April 1971. 4 fig, 1 tab, 32 ref.

Descriptors: *Beach erosion, *Sediment transport, *Ocean waves, *Tidal effects, *Boundaries (Property), Shores, Littoral drift, Beaches, Ocean currents, Seasonal Fluctation.

The width of any given sandy beach will vary with the seasons primarily because of the varying characteristics of wave attack throughout the year. Generally, beaches are wider in summer than in winter, and the difference in width between these two seasons may in some localities amount to as much as 200 feet. With this in mind an owner of upland property should recognize that the physical location of the mean high-tide line on the ground is thus a fluctuating line and not a fixed or permanent line. He should also recognize that any structure placed within the range of anticipated seasonal migrations near the tide land boundary (mean high-tide line) DURING THE SUMMER MAY BE ENDANGERED BY THE CUTTING ACTION OF THE WAVES DURING THE WINTER. In addition, damages to adjacent lands as a result of his structure interfering with natural littoral processes may constitute a basis for legal action. (Woodard-USGS)
W71-13827

MIXING PROCESSES IN GREEN BAY,
Wisconsin Univ., Madison. Marine Studies Center.
For primary bibliographic entry see Field 02H.
W71-13828

LANDSLIDES ALONG THE ILLINOIS RIVER VALLEY SOUTH AND WEST OF LA SALLE AND PERU, ILLINOIS,
Illinois State Geological Survey, Urbana.
P. B. DuMontelle, N. C. Hester, and R. E. Cole.
Illinois Geological Survey Environmental Geology Notes, No 48, July 1971. 16 p, 8 fig, 17 ref.

Descriptors: *Landslides, *Clays, *Shales, *Illinois, *Geologic investigations, Geologic control, Mass wasting, Slope stability, Rainfall, Hydrogeology.
Identifiers: *La Salle (Ill), *Peru (Ill).

Slopes in the La Salle-Peru region of Illinois are unstable because of a combination of physical factors: (1) the slopes consist of clay-rich shale; (2) the slopes are generally steeper than 20 deg; (3) the climate of the area typically includes periods of heavy rainfall. Abnormally high amounts of rainfall help to cause rapid erosion of the toe of the slopes, increase the bearing weight on the underlying formations, and lubricate the materials in the slope, causing them to flow or fracture. Both ground and air reconnaissance are helpful in determining and evaluating the extent of landslides. Geologic field studies reveal that sliding will recur naturally. When the critical balance of these slopes is upset by improper construction activity, the process of sliding is accelerated and damage may be extensive. If the existing or potential hazard of these slopes is recognized, unplanned expansion of urban construction can be discouraged and disasters prevented. (Knapp-USGS)
W71-13853

GERMANIUM IN IRON-MANGANESE CONCRETIONS OF RECENT SEDIMENTS (Germaniy v zhelezo-margantsevykh konkretsiyakh sovremennykh osadkov),
Akademiya Nauk SSSR, Gelendzhik. Institut Okeanologii.
I. I. Volkov, and V. S. Sokolov.
Litologiya i Poleznyye Iskopayemyye, No 6, p 24-29, November-December 1970. 2 tab, 22 ref.

Descriptors: *Sedimentation, *Bottom sediments, *Geochemistry, Iron, Manganese, Clays, Mud, Calcium carbonate, Sea water, Alkalis (Bases), Chemical analysis.
Identifiers: *USSR, *Germanium, *Concretions, Black Sea, Indian Ocean, Pacific Ocean, Ooze, Enclosing sediments, Volcanism.

The behavior of germanium during the formation of iron-manganese concretions in the Black Sea, Indian and Pacific Oceans was examined to determine the geochemistry of this element, in recent sediments. Iron-manganese-concretion and enclosing-mud data for the Black Sea were obtained from concretion-rich bottom sediments near the southwestern shores of the Crimea. Oceanic concretion data were based on a study of carbonate-rich Globigerina ooze from the Indian Ocean and of red clays from the Pacific Ocean. The germanium content was always lower in the concretions than in the enclosing sediments. The germanium values for concretions and enclosing sediments of the Black Sea averaged 0.00017 and 0.00022%; those for the Indian Ocean, 0.00009 and 0.00015%; and those for the Pacific Ocean, 0.00009 and 0.00018%, respectively. All figures were calculated for carbonate-free sediment volumes. A low geochemical mobility of germanium during Fe-Mn concretion formation in the Black Sea and in the oceans was due to its close genetic relationship with the clayey silicate fraction of recent sediments. The decisive role of clayey sediments in influencing the behavior of germanium in the sedimentary process, in contrast to Fe and Mn hydroxides, may be related to the great concentration of clay particles during sedimentation. (Josefson-USGS)
W71-13860

SELENIUM IN RECENT BLACK SEA SEDIMENTS (Selen v sovremennykh osadkakh Chernogo morya),
Akademiya Nauk SSSR, Gelendzhik. Institut Okeanologii.
Ye. G. Sokolova, and M. F. Pilipchuk.
Akademiya Nauk SSSR Doklady, Vol 193, No 3, p 692-695, 1970. 2 fig, 1 tab, 21 ref.

Descriptors: *Geochemistry, *Sediments, *Sedimentation, Sulfur, Sulfides, Hydrogen sulfide, Calcium carbonate, Particle size, Sedimentary rocks, Sands, Distribution patterns, Maps.
Identifiers: *USSR, *Black Sea, *Selenium, Ooze, Selenites, Selenates, Coquina.

Samples of Black Sea surface sediments were examined to study the distribution patterns of selenium in sea basins and to calculate the average selenium concentrations in natural sediment and in its carbonate-free fraction. The selenium content of the surface sediment layer varies between 1 and 42 hundred thousandths of a percent. The range of the selenium content recalculated to carbonate-free matter increased from 1 to 102 hundred thousandths of a percent. A clear relationship was established between the selenium concentration and the particle size of the sediment. The selenium content of natural sediment continuously increases from sand and coquina to the finely divided ooze in the deep part of the sea. Sketch maps outlining the selenium content and the division of the basin into zones were constructed for studying the effect of individual physiochemical and hydrodynamic factors on the lateral distribution of selenium in the basin. The effect of individual coastal stretches on the distribution of selenium in surface sediment appears to be virtually negligible. The distribution of selenium in the carbonate-free fraction of the sediment is very similar to that in natural sediment. Comparison of data on the selenium content of the two sediment types with the lateral distribution shown on sketch maps clearly reveals their great similarity and reinforces the geochemical pattern of selenium distribution for natural sediment and its carbonate-free fraction. (Josefson-USGS)
W71-13865

STRUCTURE AND FORMATION OF TERRACES IN THE VYCHEGDA RIVER BASIN (Stroyeniye i usloviya formirovaniya terras basseyna r. Vychegdy),
Moscow State Univ. (USSR). Chair of Geomorphology.
L. M. Potapenko.
Vestnik Moskovskogo Universiteta, Seriya 5, Geografiya, No 3, p 97-104, May-June 1971. 3 fig, 1 tab, 7 ref.

Descriptors: *Geomorphology, *Terraces (Geological), *River basins, *Geologic investigations, Stratigraphy, Petrography, Structural geology, Geologic time, Alluvium, Lake stages, Valleys, Water levels, Water level fluctuations, Hypsometric analysis.
Identifiers: *USSR, *Vychegda River, Komi ASSR, Lake terraces, River terraces, Transgression, Regression.

Current views on the structure and formation of terraces in the Vychegda River basin (Komi ASSR) are examined and refined. Four morphologically distinct terraces are identified on the basis of age: (1) the Odintsovsko-Moscow terrace, the oldest and highest terrace, formed only in the upper course of the Vychegda River east of the village of Derevyansk; (2) the Mikulinsko-Early Valdaian terrace, which covers large areas in the valleys of the Vychegda River and its major tributaries; (3) the Middle-Late Valdaian terrace, which is widespread in the Vychegda River basin; and (4) the Late Valdaian-Holocene terrace, which consists of alluvial deposits of varying age and elevation. The Odintsovsko-Moscow, Mikulinsko-Early Valdaian, and the Middle-Late Valdaian terraces are polygenetic in structure and are composed of (1) lacustrine deposits, which form a morphologically distinct lake terrace in the lower and middle reaches, and (2) underlying alluvial deposits, which form a buried river terrace. Alluvium forms the surface of the lake terrace in the upper reaches of the river where the lacustrine deposits wedge out. The only exception is the oldest and highest terrace, where the alluvium is completely buried beneath the lacustrine deposits. (Josefson-USGS)
W71-13868

A SOIL ERODIBILITY NOMOGRAPH FOR FARMLAND AND CONSTRUCTION SITES,
Agricultural Research Service, Lafayette, Ind. Soil and Water Conservation Research Div.
W. H. Wischmeier, C. B. Johnson, and V. Cross.
Journal of Soil and Water Conservation, Vol 26, No 5, p 189-193, September-October 1971. 2 fig, 1 tab, 7 ref.

Descriptors: *Soil erosion, *Construction, *Particle size, Urbanization, Organic matter, Rainfall intensity, Frequency analysis, Excavation, Cities, Land use, Storm runoff.
Identifiers: *Soil erodibility nomograph, Urban hydrology.

A new soil particle-size parameter was found and used to derive a convenient erodibility equation that is valid for exposed subsoils as well as farmland. A simple nomograph provides quick solutions to the equation. Only five soil parameters need to be known: percent silt, percent sand, organic matter content, structure, and permeability. This new technique for computing soil erodibility can greatly facilitate evaluation of the erodibility factor for hundreds of agricultural soils throughout the country. It perhaps can be of even greater value in planning sediment-control measures for construction sites and other disturbed areas. In planning suburban construction-site developments it may be possible to adjust the designed depth of some cuts so they will terminate either above or below a highly erodible soil layer and thereby reduce substantially the potential sediment yield. In some situations the exposed soil layer or some intermediate horizon may be less erodible than the topsoil or more responsive to certain chemical soil stabilizers. With on-site values of the erodibility factor K available, a contractor can use the universal soil-loss equation to compute probable sediment yields for the area that he plans to develop. (Knapp-USGS)
W71-13910

EFFECT OF ROW GRADES AND TILLAGE SYSTEMS ON SOIL AND WATER LOSSES,
Agricultural Research Service, Ames, Iowa. Soil and Water Conservation Research Div.
W. C. Moldenhauer, W. G. Lovely, N. P. Swanson, and H. D. Currence.
Journal of Soil and Water Conservation, Vol 26, No 5, p 193-195, September-October 1971. 4 fig, 3 tab, 15 ref.

Descriptors: *Soil erosion, *Irrigation, *Water loss, *Slopes, *Cultivation, Soil management, Soil-water-plant relationships, Erosion control, Planting management, Soil conservation, Terracing.

Three tillage methods were compared for their effectiveness in controlling soil and water losses with up-and-down-hill planting on a range of slopes from 3.4 to 9 percent using a rotating-boom rainfall simulator. Of the three methods, ridge planting proved to be the most effective means of controlling soil losses. Both soil and water losses were independent of slope with this method. Till planting, though superior to conventional tillage in controlling soil losses, was not nearly as effective as ridge planting. (Knapp-USGS)
W71-13911

EFFECT OF EXCESSIVE-RATE RAINSTORMS ON EROSION,
Agricultural Research Service, Holly Springs, Miss. North Mississippi Branch Experiment Station.
J. D. Greer.
Journal of Soil and Water Conservation, Vol 26, No 5, p 196-197, September-October 1971. 3 fig, 1 tab, 5 ref.

Descriptors: *Soil erosion, *Rainfall intensity, *Rainfall-runoff relationships, *Mississippi, Soil conservation, Sampling, Vegetation effects, Slopes.
Identifiers: Excessive-rate rainstorms.

Six years of rainfall, runoff, and erosion data from quarter-acre, graded-row corn plots on 2.5, 4.25, and 10% slopes in Mississippi show that rainfall intensity is a major factor in the erosion process. Excessive-rate rainstorms (rainfall with an intensity equal to or exceeding 3.00, 1.40, 1.00, and 0.80 inches per hour for 5, 15, 30, and 60 minutes respectively) produced about 50% of the total soil loss from these plots during the approximately two months when neither residue nor canopy cover protected the soil. Excessive-rate storms during these two months accounted for only about 6% of the total rainfall. (Knapp-USGS)
W71-13912

TERRACES REDUCE RUNOFF AND EROSION ON SURFACE-MINE BENCHES,
Northeastern Forest Experiment Station, Berea, Ky.
For primary bibliographic entry see Field 04D.
W71-13913

PARAMETERS FOR BED SLIP POINT IN TWO-PHASE FLOW,
Queen's Univ., Kingston (Ontario). Dept. of Civil Engineering.
K. C. Wilson.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY10, Paper 8426, p 1665-1679, October 1971. 5 fig, 6 ref.

Descriptors: *Sediment transport, *Closed conduit flow, *Pipe flow, *Bed load, Discharge (Water), Velocity, Tractive forces, Particle size.
Identifiers: Two-phase flow.

The limit of sediment deposition is given by the slip point, when the bed begins to slide. The pressure gradient at slip point depends on the angle subtended by the bed and other factors. Parameters representative of the pressure gradient, discharge and concentration of solids at the slip point are expressed in terms of this angle. For specific cases, with given pipe size and particle properties, the angle of deposition can be eliminated by plotting gradient parameter versus discharge parameter. This gives a graph similar to those generally used for plotting experimental results for two-phase pipeline flow, on which the locus of the slip point defines regions with and without deposition. The discharge at the slip point rises to a maximum and then decreases with increasing gradient. In combination with efficiency considerations this indicates that it is desirable to operate pipelines with high solids concentration. (Knapp-USGS)
W71-13916

DEPOSITIONAL STRUCTURES AND PROCESSES IN THE NON-BARRED HIGH-ENERGY NEARSHORE,
Geological Survey, Menlo Park, Calif.
H. E. Clifton, R. E. Hunter, and R. L. Phillips.
Journal of Sedimentary Petrology, Vol 41, No 3, p 651-670, September 1971. 27 fig, 1 tab, 35 ref.

Descriptors: *Beaches, *Surf, *Sedimentary structures, *Sediment transport, Erosion, Sedimentation, Paleohydrology, Stratigraphy, Ripple marks, Dunes, Sand waves, Regime, Waves (Water), Sands, Bores.
Identifiers: High-energy beaches.

In a high-energy coastal environment where long-period swell enters a nearshore uncomplicated by offshore bars, sedimentary structures develop on the seafloor in facies that trend parallel to the zones of different wave activity. In the offshore, small sand ripples are the most common depositional structure, but in the nearshore larger bed forms predominate. Seaward from the line of breakers, in the zone of wave build-up, are landward-oriented lunate megaripples. Near the outer portion of the surf zone the bed form is planar, but, in the inner portion of the zone, an area of large-scale bed roughness is common. Within the swash zone, the bed form is again planar. The major features of the bed forms can be interpreted in terms of flow regime. The stronger of the two opposing transient currents caused by passing waves produces structures analogous to those produced by continuous, unidirectional currents. Within each of the structural facies a distinctive set of internal structures is produced. The asymmetric ripple facies have shoreward-inclined ripple cross-lamination and gently inclined cross-stratification. The lunate megaripples produce medium-scale landward-dipping foresets. (Knapp-USGS)
W71-13919

ORIENTATION OF EMPTY PELECYPOD SHELLS AND SHELL FRAGMENTS IN QUIET WATER,
Geological Survey, Menlo Park, Calif.
H. E. Clifton.
Journal of Sedimentary Petrology, Vol 41, No 3, p 671-682, September 1971. 15 fig, 4 tab, 19 ref.

Descriptors: *Sedimentation, *Deposition (Sediments), *Shellfish, *Sedimentary structures, Particle size, Particle shape, Bottom sediments, Benthos.
Identifiers: Shells, Bioturbation.

The orientation of pelecypod shells and shell fragments on sediment unaffected by waves or currents, whether on vegetated or unvegetated unrippled sand or on solid coral, is predominantly with concave sides up. This orientation occurs both for open articulated empty valves and for isolated disarticulated valves. The degrees of orientation differs with shell size; the smaller shells are less preferentially oriented concave-up than are the larger shells. The concave-up orientation results from the activity of predators and scavengers, from bioturbation, or from a combination of the two mechanisms. An experiment that exposed nearly 1200 shells to 40 days of bioturbation demonstrated that disturbance by organisms is an effective agent for producing a dominantly concave-up orientation. In general, the tendency to be rotated to a concave-up position increases with increasing shell size to the point where shells are too large to be readily overturned by most organisms. The orientation of shells in quiet water differs markedly from those orientations produced under most conditions of waves or currents. Although concave-up assemblages can be produced by deposition from turbidity currents or from the transport of shells across small ripples, analysis of orientation as it relates to shell size and shape may provide a means of identifying specific depositional mechanisms or conditions. (Knapp-USGS)
W71-13920

HYDRAULIC FRACTIONATION OF HEAVY MINERAL SUITES ON AN UNCONSOLIDATED RETREATING COAST,
Old Dominion Univ., Norfolk, Va. Inst. of Oceanography.
D. J. P. Swift, C. E. Dill, Jr., and J. McHone.
Journal of Sedimentary Petrology, Vol 41, No 3, p 683-690, September 1971. 4 fig, 4 tab, 29 ref. (Also supported by USGS Office of Marine Geology). Coastal Eng Res Center Contract DACW-72-69-C-0016.

Descriptors: *Beaches, *Sedimentation, *Provenance, Sediment transport, Beach erosion, Sands, Mineralogy, Distribution patterns, Density, Pleistocene epoch, Quaternary period.
Identifiers: *Heavy minerals, Sorting.

In a study of sediments of the North Carolina-Virginia coast, undertaken in order to determine the genesis of the coastal sands, an examination was made of the 85-177 micron heavy mineral fraction. Within this fraction, three well-defined heavy minerals provinces were found. Amphibole-garnet-kyanite suites exist both on the beach and offshore, separated by an amphibole-epidote-kyanite suite in the nearshore zone. These three provinces correspond to three well-defined grain size provinces generated by the contrasting hydraulic regimes of the surf, zone of shoaling waves, and the shelf floor. Coastwise variation in heavy mineral content is also apparent, but weaker. The most important trends are an increase in garnet and opaque minerals and a decrease in amphibole on the beach from Cape Henry towards Cape Hatteras. These trends are not easily correlated with the reported pattern of littoral drift, and may reflect instead the effect of southward-increasing mean annual wave heights on sediment eroded from the underlying Pleistocene formations. Interpretation of the coastwise trend is complicated by the fact the Pleistocene substrate is itself a beach ridge sequence with its own pattern of heavy mineral variation. The simplest interpreta-

tion of the heavy mineral data is that the respective provinces consist of autochthonous fractionates of the Pleistocene substrate, generated by shore face retreat. (Knapp-USGS)
W71-13921

CLAY MINERAL COMPOSITION AND GEOLOGIC SIGNIFICANCE OF SOME BEAUFORT SEA SEDIMENTS,
Alaska Univ., College. Inst. of Marine Science.
A. S. Naidu, D. C. Burrell, and D. W. Hood.
Journal of Sedimentary Petrology, Vol 41, No 3, p 691-694, September 1971. 1 fig, 1 tab, 22 ref. USAEC Contract AT (04-3)-310 ONR Res Contract NOOD 14-67-A-3017-0001.

Descriptors: *Clay minerals, Bottom sediments, *Provenance, *Paleoclimatology, Distribution patterns, Water chemistry, Illite, Kaolinite, Arctic Ocean.
Identifiers: Beaufort Sea.

The fractions of bottom sediments smaller than 2 microns in size from the Beaufort Sea and Arctic Ocean, were analyzed for clay mineral composition. In all of these high latitude sediments, illite is predominant, Chlorite and kaolinte occur in significant amounts, and smectite is least abundant. This occurrence of kaolinite is noteworthy. Since the generally accepted view related to marine sediments is that kaolinite is a low latitude clay mineral, it is suggested that the use of clay minerals in the inference of paleoclimates should be made with great caution. (Knapp-USGS)
W71-13922

SOME TECHNIQUES IN EXPERIMENTAL SEDIMENTOLOGY,
Reading Univ. (England). Sedimentology Research Lab.
J. R. L. Allen.
Journal of Sedimentary Petrology, Vol 41, No 3, p 695-702, September 1971. 4 fig, 19 ref.

Descriptors: *Sedimentary structures, *Laboratory tests, *Analytical techniques, *Sampling, *Data collections, Model studies, Hydraulic models, Sedimentology.
Identifiers: *Experimental sedimentology.

The following techniques found useful in experimental sedimentology are described and illustrated: (1) the preservation and reproduction of sedimentary structures using molds and replicas in plaster of paris, polyvinylchloride, and rubber latex, (2) the preservation of internal sedimentary structures in sand beds using latex, and (3) visualization of flow on models made from plaster of paris. Some of the techniques have been successfully applied in field studies. (Knapp-USGS)
W71-13923

ROLLABILITY, A FUNCTIONAL SHAPE PROPERTY OF SAND GRAINS,
Groningen Rijksuniversitet (Netherlands). Geological Inst.
A. M. Winkelmolen.
Journal of Sedimentary Petrology, Vol 41, No 3, p 703-714, September 1971. 7 fig, 14 ref.

Descriptors: *Particle shape, *Sands, *Laboratory tests, Sedimentation, Sedimenttransport, Deposition (Sediments), Beaches, Dunes, Bottom sediments, Erosion, Sedimentary structures, Provenance.
Identifiers: Rollability (Sands).

A new method is presented for determining rollability of the angle of slope on which a sand grain will roll down in air. It is measured on the inside of a slightly inclined revolving cylinder. The grains emerge from the lower end of the cylinder and the time it takes them to reach this lower end is the measure for their rollability. The property rollability correlates well with the influence of grain shape in other processes such as settling in water. Graphs are plotted which show the distribution of the relative rollability values over the size fractions. This property is called the Shape Distribution Character. It appears to be characteristic for the mode of origin. Examples are shown of genetic relationships in the complementary character of the shallow offshore zone with the beach, the beach and adjoining dunes, and the eolian cover sands with the areas from which the sands have been blown out. (Knapp-USGS)
W71-13924

SEDIMENTOLOGY OF APOLLO 11 AND 12 LUNAR SOILS,
National Aeronautics and Space Administration, Houston, Tex. Manned Spacecraft Center.
J. F. Lindsay.
Journal of Sedimentary Petrology, Vol 41, No 3, p 780-797, September 1971. 13 fig, 1 tab, 23 ref.

Descriptors: *Soil formation, *Sediment transport, *Sampling, *Moon, *Stratigraphy, Craters, Cores, Mineralogy, Particle size.
Identifiers: *Lunar sedimentology, Lunar soils.

Differences in the modal composition of lunar soil samples from an Apollo 11 core tube suggest the presence of at least three depositional units. The double-drive-tube core sample from the Apollo 12 site shows evidence of at least 16 depositional episodes. The earliest recognizable event at the Apollo 12 site carried light-colored soil rich in feldspathic-rock fragments into the area and may be related to ejection of ray material from Copernicus. Prior to the formation of Surveyor Crater at least 11 depositional episodes took place. Most of the soil at the Apollo 11 and 12 sites was probably generated locally with a smaller contribution coming from a more distant source possibly in the lunar highlands. Over geologic time the soil evolved to its present form due to impact vitrification and comminution of the detrital material. Initially comminution was probably the dominant process modifying the grain-size distribution of the lunar soil, but beyond a point in time its effect was neutralized by impact vitrification which removed finer-grained materials from the soil both by fusion and agglutination. The overall effect with time was to stabilize the median grain size of the soil and produce an increasingly more negatively skewed and more-poorly-sorted grain-size distribution. Since glass production is energy dependent, the glass content of the lunar soil is a measure of the total energy involved in its sedimentation and can thus be used as a measure of maturity. The Apollo 11 samples are more mature than those from Apollo 12 site which is consistent with the age difference between the two sites. (Knapp-USGS)
W71-13925

BUDGET OF CALCIUM CARBONATE, SOUTHERN CALIFORNIA CONTINENTAL BORDERLAND,
Hawaii Inst. of Geophysics, Honolulu.
S. V. Smith.
Journal of Sedimentary Petrology, Vol 41, No 3, p 798-808, September 1971. 2 fig, 7 tab, 39 ref. ONR Project NR 083 603.

Descriptors: *Sedimentation, *Chemical precipitation, *Carbonates, *Water chemistry, California, Calcium carbonate, Sea water, Calcite, Dolomite, Provenance, Sediment transport, Mineralogy, Sampling.
Identifiers: Carbonate budget.

The transfer of particulate CaCO3 to or from the water mass of the Southern California Continental Borderland can be described by means of a budget. The sum of mechanical plus biological plus chemical transfer must equal zero if the system is one of steady state. Deposition of CaCO2 on the basin floors, on the slopes, and on the shelf totals 1,250 million kg/yr. River supply of particulate CaCO3 totals 160 million kg/yr. No other mechanical transfer processes are quantitatively significant. Biological production of CaCO3 inlcudes approximately 400 million kg/yr by macrobenthos of the shallow rocky shelf, 340 million kg/yr by other macrobenthos, 2,470 million kg/yr by planktonic plus benthic foraminifera, and 250 million kg/yr by other organisms. Chemical transfer includes solution of 2,000 million kg/yr CaCO3. The CaCO3 transfer terms sum to zero, within the limits of error. The carbonate minerals present include Mg-calcite, aragonite, and dolomite. All carbonate minerals other than dolomite show evidence of solution. Most of the Ca deposited in Borderland sediment is derived from ocean waters flowing through the Borderland rather than from river water input. Water associated with the oxygen minimum is important in dissolving particulate CaCO3. Shallow water precipitation and intermediate water solution may be an important process of dissolved Ca relocation from one water mass to another. (Knapp-USGS)
W71-13926

DOLOMITE, PHOSPHORITE, AND CARBONATE DIAGENESIS ON A CARIBBEAN SEAMOUNT,
Bedford Inst., Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
For primary bibliographic entry see Field 02K.
W71-13927

TEXTURE OF ICE-CORED DEPOSITS FROM TEN ALASKAN VALLEY GLACIERS,
Memorial Univ. of Newfoundland, St John's. Dept. of Geology.
For primary bibliographic entry see Field 02C.
W71-13928

POLYGONAL PATTERNS IN MUDDY TIDAL FLATS,
Department of the Environment, Sainte-Foy (Quebec).
For primary bibliographic entry see Field 02L.
W71-13929

GEOLOGIC SIGNIFICANCE OF MICROBORING FUNGI AND ALGAE IN CAROLINA SHELF SEDIMENTS,
Duke Univ, Durham, N.C. Dept. of Geology.
R. D. Perkins, and S. D. Halsey.
Journal of Sedimentary Petrology, Vol 41, No 3, p 843-853, September 1971. 14 fig, 24 ref. (Supported also by U S Geological Survey's Marine Geology Program). NSF Grant G-17669.

Descriptors: *Sedimentary structures, *Erosion, *Vegetation effects, *Algae, *Bottom sediments, Fungi, Carbonates, Carbonate rocks, Sediments, Sedimentation, Sea level, Continental shelf, Diagenesis, Mineralogy, Provenance.
Identifiers: *Organic erosion.

Carbonate components of relict continental margin sediments off North Carolina show abundant evidence of microborings related to endolithic fungi and algae. Microborings were observed in bottom sediments collected from 165 sites ranging in depth from the intertidal to 780 meters. The three main types of microborings are: (a) fungi, 1-4 microns in diamerer, (b) a septate green alga, 10 microns in diameter, and (c) a diagnostic siphonaceous green alga, 15-20 microns in diameter. Of these endolithic plants, fungi were the most abundant as well as most widespread. A distinctive, siphonaceous green alga defined three linear bands of highly bored sediments believed to reflect nearshore zones of high algal boring activity. The innermost zone, extending from the present day intertidal to depths of approximately 25 meters, is considered to be presently active; the outer two zones on the shelf are interpreted as marking relict shoreline positions associated with lower sea level stands. In situ organic erosion by microboring organisms is believed to be an important source of carbonate fines in Carolina shelf sediments. Molluscan components are being selectively attacked and removed from the carbonate fraction through

the activity of endolithic fungi and algae. The relative abundance of carbonates in Carolina shelf sediments is therefore believed to be not only related to skeletal productivity and degree of dilution by clastics, but also to the degree of organic erosion to which sediments have been subjected. (Knapp-USGS)
W71-13930

THE GENESIS OF SOME SIDERITIC BEDS IN THE YORKSHIRE LIAS (ENGLAND),
Oxford Univ. (England). Dept. of Geology and Mineralogy.
B. W. Sellwood.
Journal of Sedimentary Petrology, Vol 41, No 3, p 854-857, September 1971. 1 fig, 16 ref.

Descriptors: *Sedimentation, *Diagenesis, *Mineralogy, *Iron, *Organic matter, Dissolved oxygen, Oxidation, Oxidation-reduction potential, Stratigraphy, Water chemistry.
Identifiers: Yorkshire (England), Siderite.

Pliensbachian (Lower Lias) sediments from Yorkshire, England, contain semicontinuous bands of mudstone cemented by impure siderite. The assemblage of burrows and faunas associated with them suggest that the siderite was selectivity precipitated close to successive sediment/water interfaces. These substrates were oxidizing in their upper portions, but reducing at depth. The reduced regions provided ferrous iron which was then precipitated as the oxide and hydroxide near the sediment/water interfaces. During later burial and renewed sedimentation, reduction of this concentrated iron allowed its reaction with CO2 which resulted from the decay of organic matter. SO4 ions from sea water were excluded by the overlying sediment which thus prevented the formation of much pyrite. Reduced and increased rates of sedimentation alternated to produce the rhythmic alterations of siderite bands and shale. (Knapp-USGS)
W71-13931

FLOODS OF DECEMBER 1964 AND JANUARY 1965 IN THE FAR WESTERN STATES, PART 2. STREAMFLOW AND SEDIMENT DATA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-13932

2K. Chemical Processes

ECOLOGY OF THE SUNDAYS RIVER: I. WATER CHEMISTRY,
Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies.
A. T. Forbes, and B. R. Allanson.
Hydrobiologia. 36 (3/4): 479-488, Illus, Maps, 1970. (Ger summ).
Identifiers: Africa, Chemical, Chemistry, Ecology, River, South, Sundays, Water.

Water analyses were done on samples taken at a series of points along the Sundays River in the Eastern Cape, South Africa. The chemical characteristics of the water then correlated with the geological and geographical nature of the catchment.—Copyright 1971, Biological Abstracts, Inc.
W71-13110

CONTRIBUTION TO THE STUDY OF THE STREAMS OF PROVENCE. ECOLOGY OF A THERMAL SPRING: LA DURANCOLE,
Aix-Marseille Univ. (France). Faculte des Sciences.
D. Schachter, R. N. Razakandisa, and A. Kiener.
Ann Fac Sci Marseille. 43B: 127-134, Illus, Map, 1970. (Engl summ).
Identifiers: Durancole, Ecology, Fauna, France, La, Minerals, Provence, Spring, Streams, Temperature, Thermal.

A thermal stream 'La Durancole' in southern France wa studied. The temperature of the water is constant (18 deg C) during the year, the Cl content is very low (0.135 to 0.530 g/1) and the Ca/Cl value is high. The fauna includes freshwater and brackishwater species. Some biological observations on the biocenosis are discussed.—Copyright 1971, Biological Abstracts, Inc.
W71-13111

BIOGEOCHEMISTRY OF THE STABLE ISOTOPES OF HYDROGEN AND CARBON IN SALT MARSH BIOTA,
Texas Univ., Austin. Dept. of Botany.
For primary bibliographic entry see Field 02L.
W71-13121

SOIL SOLUTION COMPOSITION AND STABILITY OF CLAY MINERALS,
Washington State Univ., Pullman. Coll. of Agriculture.
For primary bibliographic entry see Field 02G.
W71-13147

BUBBLE COALESCENCE AND GAS TRANSFER IN AQUEOUS ELECTROLYTIC SOLUTIONS,
Maine Univ., Orono. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 05G.
W71-13282

BEHAVIOR OF GAS BUBBLES IN AQUEOUS ELECTROLYTE SOLUTIONS,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13284

PHOTOMETRIC DETERMINATION OF SMALL AMOUNTS OF OXYGEN IN WATER WITH 3,3'-DIMETHYLNAPHTHIDINE,
Central Sewage Treatment Plant, Brno, (Czechoslovakia).
For primary bibliographic entry see Field 05A.
W71-13292

GEOCHEMICAL EVOLUTION OF THE BLACK SEA IN THE HOLOCENE EPOCH (Geokhimicheskaya evolyutsiya Chernogo morya v golotsene),
Akademiya Nauk SSSR, Moscow. Geologicheskii Institut.
N. M. Strakhov.
Litologiya i Poleznyye Iskopayemyye, No 3, p 3-17, May-June 1971. 5 fig, 6 tab, 19 ref.

Descriptors: *Geochemistry, *Sedimentation, *Sediments, *Recent epoch, Organic matter, Hydrogen sulfide, Molybdenum, Manganese, Iron, Calcium carbonate, Carbonates, Calcium chloride, Plankton, Mud, Salts.
Identifiers: *USSR, Black Sea, Mediterranean Sea, Ooze, Sapropel, Coccoliths, Mineralization, Holocene epoch.

The geochemistry of the Black Sea has undergone rapid change over the last 8,000 years. The presence of Black Sea deposits rich in organic matter coincides chronologically with the appearance of Mediterranean waters in the Black Sea basin and with the hydrogen sulfide contamination of the water. An initially high accumulation of organic matter in the sediments immediately following the appearance of Mediterranean waters in the Black Sea was followed by a sharp decrease in the organic carbon content, although the hydrogen sulfide contamination continued in an even more intense form. The most important result of the appearance of these waters in the basin was the development of geochemical processes nonexistent in the new euxinic period. These processes include: (1) flourishing of plankton and formation of sapropel sediments rich in organic carbon, molybdenum and several other trace elements; (2) subsequent evolution of large numbers of coccolithophorids owing to an increase in the calcium carbonate content of the sediments; (3) formation of large amounts of hydrogen sulfide, spreading upward from deep-sea ooze and contributing to the concentration of manganese in the hydrogen sulfide zone; (4) downward diffusion of hydrogen sulfide from the ancient and recent Black Sea sediments, generating a hydrotroilite horizon in the upper parts of the new euxinic deposits and generally altering their original geochemical appearance; and (5) formation of mud waters with a calcium chloride type of salinity. (Josefson-USGS)
W71-13299

ZIRCONIUM IN RECENT BLACK SEA SEDIMENTS (Tsirkoniy v sovremennykh osadkakh Chernogo morya),
Akademiya Nauk SSSR, Moscow. Institut Okeanologii.
For primary bibliographic entry see Field 02J.
W71-13300

ZIRCONIUM IN BLACK SEA SEDIMENTS (Tsirkoniy v osadkakh Chernogo morya),
Akademiya Nauk SSSR, Moscow. Institut Okeanologii.
M. A. Glagoleva.
Litologiya i Poleznyye Iskopayemyye, No 3, p 27-35, May-June 1971. 7 fig, 4 tab, 14 ref.

Descriptors: *Sediments, *Sedimentation, *Geochemistry, Cores, Sampling, Diagenesis, Particle size, Organic matter, Organic acids, Calcium carbonate, Distribution patterns.
Identifiers: *USSR, *Black Sea, *Zirconium, Zircon, Pelagic muds, Euxinic sediments, Supergenesis, Pelites.

Core samples or recent, ancient, and new euxinic Black Sea sediments were examined for determining their zirconium content. The content of zirconium in all of the samples studied ranged from 0.005 to 0.038%. The total content of zirconium in the natural sediments increased in a downward direction from 0.006-0.022% in recent deposits to 0.016-0.028% in new euxinic deposits. The average zirconium values for the new euxinic deposits were 0.0198-0.0369% and were higher than those for the recent (0.0148-0.0269) and ancient (0.0130-0.0239%) deposits. The higher zirconium content in the new euxinic deposits is associated with the active hydrodynamic regime and comparatively weak mechanical differentiation of recent sedimentary material. The geochemically mobile form of zirconium in the sediments is insignificant and is usually 1.2-12% of the total zirconium content. The mobile zirconium content in fine pelagic muds of ancient and new euxinic deposits is higher than that in coarse muds. The increased content in fine muds may be attributed to the more active participation of zirconium in the diagenetic processes. (See also W71-13300) (Josefson-USGS)
W71-13301

ZINC IN HOLOCENE BLACK SEA SEDIMENTS (Tsink v sovremennykh chernomorskikh otlozheniyakh),
Akademiya Nauk SSSR, Moxcow. Geologicheskii Institut.
For primary bibliographic entry see Field 02J.
W71-13305

LEAD IN HOLOCENE BLACK SEA SEDIMENTS (Svinets v sovremennykh osadkakh Chernogo morya),
Akademiya Nauk SSSR, Moscow. Geologicheskii Institut.
For primary bibliographic entry see Field 02J.
W71-13306

DISTRIBUTION OF BROMINE AND IODINE IN GROUNDWATER OF THE SOUTHERN

TIMANS (Raspredeleniye broma i ioda v podzemnykh vodakh Yuzhnogo Timana),
Akademiya Nauk SSR, Syktyvkar, Institut Geologii.
For primary bibliographic entry see Field 02F.
W71-13307

TURBIDIMETRIC-CHROMATOGRAPHIC DETERMINATION OF PETROLEUM POLLUTION IN WATER,
Vsesoyuznyi Nauchno-Issledovatelskii Institut Vodosnabzheniya, Kanalizatskii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR).
For primary bibliographic entry see Field 05A.
W71-13338

A MODIFIED SPECTROPHOTOMETRIC METHD FOR THE DETERMINATION OF AMMONIA (AND AMINO-ACIDS) IN NATURAL WATERS, WITH PARTICULAR REFERENCE TO SEA WATER,
East African Marine Fisheries Research Organization, Zanzibar (Tanzania).
V. W. Truesdale.
Analyst, Vol 96, No 1145, p 584-590, August 1971. 3 fig, 3 tab, 4 ref.

Descriptors: *Chemical analysis, *Analytical techniques, *Laboratory tests, *Ammonia, Surface waters, Methodology, Test procedures, Natural streams, Sea water, Pollutant identification.

A method for determining ammonia (and amino-acids) in sea water as described by Strickland and Parsons is modified to reduce the analysis time from 3.5 hours to 17 minutes. The addition of 0.25 g of sodium bromide to each liter of sea water being analyzed increased the rate of oxidation sufficiently to allow the oxidation step to be completed in 1.5 hours. With increased concentrations of hypochlorite added to the samples, the oxidation time of ammonium-nitrogen in sea or fresh water was reduced to 17 minutes. The results of the chemistry of each step in the analysis are included. (Woodard-USGS)
W71-13447

GEOCHEMICAL PROSPECTING FOR THORIUM BY STREAM-SEDIMENT SAMPLING, LEMHI PASS QUADRANGEL, IDAHO AND MONTANA,
Geological Survey, Denver, Colo.
M. H. Staatz, C. M. Bunker, and C. A. Bush.
GPO, Washington, DC 20402 - Price $2.75. Geological Survey Research 1971, Chapter C, Professional Paper 750-C, p C136-C140, 1971. 4 fig, 1 tab.

Descriptors: *Geochemistry, *Alluvium, *Radioisotopes, *Exploration, Sampling, Sediments, Mineralogy, Sands, Mining, Montana, Idaho.
Identifiers: *Thorium, *Geochemical prospecting, Lemhi Pass (Idaho).

In the Lemhi Pass Quadrangle, Idaho and Montana, an area that contains many thorium veins, samples of stream sediment were collected to determine whether the thorium content of the samples would aid in locating these veins. The thorium content of most of the samples ranged from 6 to 20 ppm. The wide range of thorium values is due in part to the relatively low thorium values of samples collected from streams that drain areas underlain by Challis Volcanics in contrast to higher thorium values in samples collected from streams that drain areas underlain by rocks of the Belt Supergroup, in which all the known thorium veins were found. Thorium values of four samples that were collected a short distance downstream from mine dumps on thorium veins are clearly above all background values. A comparison of the thorium content of other samples along some streams shows small increases in the thorium content of some samples collected close to and downstream from thorium veins. (Knapp-USGS)
W71-13456

CARBONATE EQUILIBRIA DISTRIBUTION AND ITS RELATION TO AN AREA OF HIGH GROUND-WATER YIELD IN NORTHWEST OHIO,
Geological Survey, Columbus, Ohio.
S. E. Norris, and R. E. Fidler.
GPO, Washington D.C. 20402-Price $2.75. Geological Survey Research 1971, Chapter C, Professional Paper 750-C, p C202-C206, 1971. 6 fig, 5 ref.

Descriptors: *Water chemistry, *Water yield, *Carbonates, *Karst, *Ohio, Groundwater recharge, Aquifer characteristics, Groundwater movement, Groundwater basins, Equilibrium, Limestones, Carbonate rocks, Saturation, Fissures (Geology), Joints (Geology).
Identifiers: Carbonate equilibria.

The distribution of areas in northwest Ohio in which the groundwater is most saturated with respect to calcium carbonate coincides closely with a regionally extensive strip of highly productive strata termed the high-yield area. Supported by the distribution pattern of selected chemical constituents in the groundwater, the carbonate saturation data indicate that the high-yield area is the principal area of recharge to the limestone and dolomite aquifer. Better understanding of this important aquifer system promotes more effective development of Ohio's groundwater resources. (Knapp-USGS)
W71-13462

THE MAIN GENETIC TYPES OF THE EARTH'S CRUST MINERAL WATERS AND THEIR DISTRIBUTION IN THE U.S.S.R.,
For primary bibliographic entry see Field 02F.
W71-13481

THE COMMON FEATURES OF THE GENESIS OF MINERAL WATERS IN THE NW PART OF THE BOHEMIAN MASSIF,
For primary bibliographic entry see Field 02F.
W71-13482

GENESIS OF MINERAL WATERS IN THE TIBERIAS-DEAD SEA-ARAVA RIFT VALLEY, ISRAEL,
For primary bibliographic entry see Field 02F.
W71-13483

GEOCHEMICAL HYDRODYNAMICS - A POSSIBLE KEY TO THE HYDROLOGY OF CERTAIN AQUIFER SYSTEMS IN THE NORTHERN PART OF THE GULF OF MEXICO BASIN,
Geological Survey, Baton Rouge, La.
For primary bibliographic entry see Field 02F.
W71-13484

THE PROBLEM OF ORIGIN OF HIGH TEMPERATURE SPRINGS OF INDIA,
Geological Survey of India, Calcutta.
G. C. Chaterji, and S. K. Guha.
Proceedings of Symposium II on Genesis of Mineral and Thermal Waters, Vol 17, Report of 23rd Session of International Geological Congress, 1968, Academia Prague, p 141-149, 1968. 1 tab, 18 ref.

Descriptors: *Thermal springs, *Water temperature, *Water quality, *Aquifer characteristics, Groundwater, Meteoric water, Groundwater recharge, Water chemistry, Hydrogeology.
Identifiers: *Thermal springs (India).

The genesis of high temperature springs of India is summarized. Primarily on the basis of geohydrological principles, meteoric water is given as the major source of recharge for the springs. Chemical evidence indicates some contributions to the springs from magmatic or juvenile sources. The chemical composition indicates comparatively shallow circulation of springwaters. The springs of the Sahyadri-Deccan group can be classed as volcanic water in a geologic setting of volcanic rocks. The source of heat supply is concluded to be a combination of (a) normal geothermal gradient, (b) deviated geothermal gradient resulting from generation and accumulation of heat due to crustal movements and (c) heat from magmatic or volcanic emanations in specific environments. (Woodard-USGS)
W71-13485

BACTERIAL ORIGIN OF SULFURIC ACID IN SULFUROUS HOT SPRINGS,
For primary bibliographic entry see Field 02F.
W71-13486

ORIGIN OF CO2 IN THE SALTON SEA GEOTHERMAL SYSTEM, SOUTHEASTERN CALIFORNIA, U.S.A.,
For primary bibliographic entry see Field 02F.
W71-13487

MERCURY-ANTIMONY-ARSENIC MINERALIZATION OF RECENT THERMAL SPRINGS OF KAMCHATKA AND THE KURILE ISLANDS (Rtutno-sur'myano-mysh'yakovaya mineralizatsiya sovremennykh gidroterm Kamchatki i Kuril'skikh ostrovov),
Institut Vulkanologii, Petropavlovsk-Kamchatskii (USSR).
For primary bibliographic entry see Field 02F.
W71-13494

FORMATION OF THE CHEMICAL COMPOSITION OF GROUNDWATERS IN THE CISCAUCASIAN AND CISCARPATHIAN DEPRESSIONS (Oformirovanii khimicheskogo sostava podzemnykh vod Predkavkazskogo i Predkarpatskogo progibov),
Moscow State Univ. (USSR).
For primary bibliographic entry see Field 02F.
W71-13495

STRONTIUM IN GROUNDWATER OF THE PRIPYAT OIL-AND GAS-BEARING BASIN (Strontsiy v plastovykh vodakh Pripyatskogo neftegazonosnogo basseyna),
Akademiya Navuk BSSR, Minsk. Laboratoriya Geokhimicheskikh Problem.
For primary bibliographic entry see Field 02F.
W71-13497

ISOTOPIC COMPOSITION OF SULFUR IN PLANTS AND ANIMALS OF WATER BODIES OF VARYING SALINITY (Izotopnyy sostav sery rasteniy i zhivotnykh iz vodoyemov razlichnoy solenosti),
Vsesoyuznyi Nauchno-Issledovatelskii Geologo-Razvedochnyi Neftyanoi Institut, Moscow (USSR).
For primary bibliographic entry see Field 02I.
W71-13498

CARBON ISOTOPIC COMPOSITION OF ORGANIC MATTER IN BOTTOM SEDIMENTS OF THE MIDDLE CASPIAN SEA REGION (Izotopnyy sostav ugleroda organicheskogo veshchestva donnykh osadkov Srednego Kaspiya),
Institut Neftekhimicheskoi i Gazovoi Promyshlennost, Moscow (USSR).
For primary bibliographic entry see Field 02J.
W71-13499

BACKGROUND AND ANOMALOUS CHLORIDE AND SULFATE RATIOS IN ATMOSPHERIC PRECIPITATION, (O fonovykh i anomal'nykh sootnosheniyakh khloridov i sul'fatov v atmosfernykh osadkakh),
Regional Sanitation and Epidemiological Station, Sverdlovsk (USSR).

For primary bibliographic entry see Field 02B.
W71-13500

A NOTE ON THE SOLUBILITY OF OXYGEN IN WATER,
New Brunswick Univ., Fredricton. Dept. of Civil Engineering.
R. C. Landine.
Water and Sewage Works, Vol 118, No 8, p 242-244, August 1971. 1 fig, 2 tab, 11 ref.

Descriptors: *Dissolved oxygen, *Solubility, Oxygenation, Saturation, Aqueous solutions.
Identifiers: Henrys law.

The solubility of oxygen in water must be known accurately for determining oxygen transfer rates. Henry's Law may be used to calculate the solubility of oxygen in water. The values calculated by Henry's Law agree well with those published, having a maximum deviation of approximately 0.1 mg/l at 0 deg C and only 0.02 mg/l at 15 and 20 deg C. Henry's Law may be used to calculate dissolved oxygen saturation concentrations from 0-100 deg C. The empirical equations commonly used do not apply over the whole range. (Knapp-USGS)
W71-13508

HYDROLOGIC RECONNAISSANCE OF GROUSE CREEK VALLEY, BOX ELDER COUNTY, UTAH,
Geological Survey, Salt Lake City, Utah.
For primary bibliographic entry see Field 02E.
W71-13509

QUALITY OF SURFACE WATERS OF THE UNITED STATES 1961: PARTS 3 AND 4, OHIO RIVER BASIN AND ST. LAWRENCE RIVER BASIN.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-13512

POTABILITY CLASSIFICATION OF GROUNDWATERS IN ARID ZONE OF WESTERN RAJASTHAN,
Indian Defence Lab., Jodhpur.
L. M. Bhandari, T. N. Bhargava, A. D. Purohit, and I. C. Gupta.
Annals of Arid Zone, Vol 9, No 4, p 221-228, December 1970. 5 tab, 4 ref.

Descriptors: *Potable water, *Water quality, *Dissolved solids, *Hydrogen ion concentration, *Groundwater, Chlorides, Sulphates, Solutes, Arid lands, Water purification, Drinking water, Public health, Water utilization.
Identifiers: *India.

Groundwater is of vital importance to arid western Rajasthan in northwestern India. Historically, groundwater sources in the area have been developed without much concern for knowledge as the cumulative effects of withdrawal. About 900 samples from 4 districts in the arid zone have been classified into 5 classes on the basis of total dissolved solids, chlorides, total hardness, and sulphates, and 3 classes with respect to pH. Fortunately, bacterial contamination is not a problem. Classes range from I (good) to V (unpotable). The potabilities of each class are discussed in light of World Health Organization standards. Class III (less satisfactory) waters are generally used in the region for drinking purposes due to scarcity of good to satisfactory potable waters. It is concluded that there is great scope for improving the potability of the waters with respect to total soluble solids, chlorides and sulphates. (Casey-Arizona)
W71-13577

CYCLIC SALT AND PLANT HEALTH,
Department of Primary Industries, Brisbane (Australia).
For primary bibliographic entry see Field 02I.
W71-13582

CHEMICAL CHARACTERISTICS OF THE WATERS OF THE LOWER SALADO RIVER (SANTA FE PROVINCE, REPUBLIC OF ARGENTINA), (IN SPANISH),
Instituto Nacional de Limnologia, Santo Tome (Argentina).
R. E. Maglianesi, and P. J. Depetris.
Physis, Vol 30, No 80, p 19-32, November 1970. 8 fig, 6 tab, 16 ref. Summary in English.

Descriptors: *Limnology, *Rivers, *Chemical analysis, *Salts, *Nitrogen compounds, Primary productivity, Cations, Anions, Carbon dioxide, Hydrogen ion concentration, Water chemistry, Sodium.
Identifiers: *Argentina.

The Rio Salado arises in the Pampean provinces, Catamarca and Salta, and runs 1500 km before emptying into the middle Parana River near the city of Santa Fe. About 80% of the river basin corresponds to the middle Salado, where irrigation development is almost total and the current is practically nonexistent, since it receives no tributaries in that region. On entering Santa Fe province, a large number of small streams flow into the river, giving it a chemical composition unlike that of the middle and upper Salado. The waters of the lower Salado were chemically analyzed at 3 different stations, 25, 67, and 135km from its mouth, from 1966-1968. A linear regression was established between dissolved solids (360 mg/l - 10 g/l) and conductivity. The presence of free carbon dioxide effects conversion of carbonates to bicarbonates, lowering water pH. The most abundant cation is Na, reaching concentrations 20 times greater than Ca. The high levels of both anions and cations indicate contamination from a saline aquifer. A mean nitrate N/ammonium N ratio of 0.95, combined with relatively high contents of other nutrients indicates high primary productivity or possibly pollution processes from human activity. (Casey-Arizona)
W71-13585

THE ORIGIN OF FIXED NITROGEN IN THE ATMOSPHERE,
Negev Inst. for Arid Zone Research, Beersheka (Israel); and Groundwater Research Centre, Jerusalem (Israel).
M. R. Bloch and W. Luecke.
Israel Journal of Earth Sciences, Vol 19, No 2, p 41-49, 1970. 8 fig, 8 ref.

Descriptors: *Nitrogen fixation, *Nitrogen compounds, *Rain water, *Chemical properties, *Surface tension, Sodium, Bubbles, Nitrates, Ammonium salts, Condensation, Evaporation, Dew, Nitrification, Arid lands, Laboratory tests, Mist, Sodium chloride, Hydrodynamics, Humidity, Temperature, Salinity, Distillation, Water vapor.
Identifiers: *Ocean spray, *Ionic ratios, *Gibbs absorption theorem, *Nitrate deserts.

Spray generated by air bubbles breaking in ocean waves is the main source of K, Na and Cl ions in the atmosphere and hence in rain and dew. The droplets so released eventually form the salt nuclei for atmospheric water condensation. Though originating in the ocean, these droplets have ionic ratios different from the bulk of ocean water. The change of ion ratios follows the requirements of the Gibbs absorption theorem, according to which the surface of the liquid will lose or gain ions according to whether they increase or decrease the liquid surface tension. Bubble experiments were performed with various ionic species, using a simple distillation and condensation device where the distilling solution and resulting vapor could each be heated separately. Under equilibrium conditions, the bubble experiments yielded results in accordance with the Gibbs adsorption theorem. According to the experiments, ocean water spray should contain 3 orders of magnitude more ammonium ion than the ocean water from which it is derived. Along the arid Chilean and Southwest African coasts, where cold polar ocean water wells up, condensation prevas over evaporation and the resulting dense mist is carried inland by westerlies. This mist is deposited in the deserts as a nitrate-containing dew. The nitrates are finally transported by seasonal rain into the nitrate deserts. It is proposed that the ammonia originally in the mist droplets is oxidized to nitrate by light and ozone. Not only does this result in nitrate deserts, but it may also be the mechanism responsible for most of the supply of fixed nitrogen to plant life. (Casey - Arizona)
W71-13591

X-RAY FLUORESCENCE ANALYSIS OF SUSPENDED SEDIMENT IN SEA WATER,
University of East Anglia, Norwich (England). School of Environmental Sciences.
J. R. Cann and C. K. Winter.
Marine Geology, Vol 11, No 3, p M33-M37, October 1971. 1 fig, 1 tab, 3 ref.

Descriptors: *Suspended load, *Sea water, *X-ray fluorescence, *Analytical techniques, Mineralogy, Chemical analysis, X-ray analysis, X-rays, Chemical analysis, Sediments, Sedimentation, Sampling.

Samples of suspended sediment filtered on cellulose ester membrane filters were analyzed directly for Fe, Mn, Ti, Ca, K, Si, and Al by X-ray fluroescence using a slightly modified thin film technique. Coefficients of variation for Fe, Ti, Ca, K, Si and Al are 6% or less. For Mn the coefficient is about 20%, this high value being due to low concentration and the low observed count rate. The method is very rapid and non-destructive, allowing samples to be used subsequently for other purposes. (Knapp-USGS)
W71-13607

COMPUTATION OF SUBARCTIC SURFACE WATER TEMPERATURES IN THE PACIFIC OCEAN IN WINTER,
V. I. Kuksa.
Oceanology (USSR), Vol 11, No 1, p 35-38, 1971. 2 fig, 7 ref.

Descriptors: *Water temperature, *Pacific Ocean, *Salinity, Surveys, Oceanography, Mixing, Ocean currents, Advection, Stratification.

The observed and computed temperature and salinity distributions at the surface of the Pacific Ocean north of 40 deg N in March are compared. Zubov's method of computing the characteristics of the vertical winter circulation (depth of penetration and its corresponding temperatures and salinities) was used. Maps of the actual temperature and salinity distributions at the surface are constructed from the results of a survey made by the American R/V Argo between January and March 1966. There is fairly good agreement between the computed and observed distributions of these properties, including temperature details. Zubov's method can serve as a reliable basis for forecasting the principal features of surface temperatures in a vast region of the Pacific north of 40 deg N. (Knapp-USGS)
W71-13617

EXCHANGE OF CO2 BETWEEN THE OCEAN AND THE ATMOSPHERE IN THE EASTERN SOUTH ATLANTIC,
Akademiya Nauk SSSR, Kaliningrad. Institut Okeanologii.
Yu. I. Lyakhin.
Oceanology (USSR), Vol 11, No 1, p 38-43, 1971. 1 fig, 2 tab, 12 ref.

Descriptors: *Sea water, *Water chemistry, *Carbon dioxide, Carbonates, Bicarbonates, Sampling, Distribution patterns, Carbon cycle, Equilibrium, Water chemistry, Oceanography.

The experimental data collected on the third cruise of the R/V Akademik Kurchatov were used to compute the partial CO2 pressure in the surface water and the surface air layer in the eastern part of the South Atlantic at the beginning of the Southern Hemisphere winter. The partial CO2 pressure in

tropical- and temperate-latitude air is 0.000320 atmospheres. CO2 liberation from the ocean into the atmosphere takes place in tropical and equatorial waters north of 15 deg S and along the African shelf to 23 deg S. The Benguela and south subtropical surface waters south of 15 deg S are undersaturated with CO2; here carbon dioxide is absorbed from the atmosphere into the ocean. This distribution of pCO2 agrees with the pattern of geostrophic water circulation. (Knapp-USGS)
W71-13618

BITUMINOUS SUBSTANCES IN OCEANIC SUSPENDED MATERIAL,
Akademiya Nauk SSSR, Moscow. Institut Okeanologii.
For primary bibliographic entry see Field 02J.
W71-13619

THE DISTRIBUTION OF RARE-EARTH ELEMENTS IN THE SEDIMENTS OF THE LAGOON ON ILE ST. PAUL,
Akademiya Nauk SSSR, Moscow. Institut Okeanologii.
Yu. A. Balashov, Yu. A. Bogdanov, I. O. Murdman, and V. I. Chernysheva.
Oceanology (USSR), Vol 11, No 1, p 58-64, 1971. 4 fig, 3 tab, 13 ref.

Descriptors: *Distribution patterns, *Bottom sediments, *Trace elements, *Water chemistry, *Chemical precipitation, Indian Ocean, Volcanoes, Weathering, Sediment transport, Geochemistry.
Identifiers: *Rare-earth elements.

The lagoon of Ile St. Paul, in the Indian Ocean, is a basin that presents an opportunity to trace the changes in the quantity and composition of the rare-earth elements in the sedimentary material during its transportation from the source of the sediments to the place of their deposition. The island's volcanic rocks and hot springs are the sources of the sediments. The changes in the composition of the rare earths in the sedimentary material are due to mechanical differentiation, as well as to processes of sorption and coprecipitation. (Knapp-USGS)
W71-13620

EXCHANGE OF SO2 BETWEEN THE ATMOSPHERE AND NATURAL WATERS,
University of East Anglia, Norwich (England). School of Environmental Sciences.
P. S. Liss.
Nature, Vol 233, No 5318, p 327-329, October 1, 1971. 1 tab, 12 ref.

Descriptors: *Chemical reactions, *Liquids, *Gases, *Surface waters, *Atomosphere, Hydrogen ion concentration, Hydrologic data, Water chemistry, Water properties, Mathematical studies, Diffusion, Phase diagrams.
Identifiers: *Sulfur dioxide exchange (Liquid-gas).

The principal factors controlling the exchange of SO2across air-water interfaces in the natural environment are discussed. Gas exchange rates are often given either as an exchange constant or its reciprocal, which measures the 'resistance' of the interface to gas transfer. At a pH of 2.8 both liquid and gas phase resistances are approximately equal but when the pH is below this value the liquid phase resistance is more important than the resistance of the gas phase. Above a pH of 2.8 the gas phase resistance becomes increasingly dominant. The exchange of SO2 is interesting because it changes from liquid to gas phase control as the pH is raised. The pH of most natural waters in surface environments is between 4 and 9. It can therefore be concluded from the calculations made that, for almost all environmental air-water interfaces, gas phase resistance should control the SO2, exchange rate. (Woodard-USGS)
W71-13623

WATER CHEMISTRY OF THE LOWER HUDSON RIVER.
New York Univ., Medical Center, N.Y. Lab. for Environmental Studies.
For primary bibliographic entry see Field 05B.
W71-13629

INTERIM REPORT ON WATER QUALITY INVESTIGATION, DeGRAY RESERVOIR, ARKANSAS,
Arkansas Univ., Fayetteville. Water Resources Research Center; and Ouachita Baptist Univ., Arkadelphia, Ark.
J. Nix.
Arkansas Water Resources Research Center, Fayetteville, Publication No 9, July 1970. 43 p, 25 fig, 2 tab. OWRR Project B-014-ARK (1).

Descriptors: *Impoundments, Trace metals, Water quality, *Dissolved oxygen, Reservoirs, Arkansas, Thermal stratification, *Hypolimnion, Stratification, *Oxygen sag.
Identifiers: *DeGray Reservoir (Ark).

Impoundment of the Caddo River near Arkadelphia, Arkansas, began in August, 1969. Detailed patterns of the dissolved oxygen distribution in this reservoir are presented for the period September, 1969 through April, 1971. Although the reservoir had not reached normal pool elevation, thermal stratification accompanied by severe hypolimnic oxygen depletion has been observed. The dissolved oxygen data show that an underflow occurs in the fall of the year and carries dissolved oxygen into the hypolimnic zone. The gradients of dissolved oxygen concentration observed during the winter indicate that the reservoir does not undergo complete mixing. A short summary of the results of trace element and other water quality parameters is also included.
W71-13812

SALT MEASUREMENT ON THE COAST OF BARBADOS, WEST INDIES,
McGill Univ., Montreal (Quebec).
For primary bibliographic entry see Field 05B.
W71-13831

WATER-QUALITY AND QUANTITY DATA, EAST FORK KAWEAH RIVER BASIN, CALIFORNIA, 1969,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02E.
W71-13843

THE WATER QUALITY OF SAM RAYBURN RESERVOIR, EASTERN TEXAS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02H.
W71-13854

WATER RESOURCES DATA FOR COLORADO: PART 2. WATER QUALITY RECORDS, 1970.
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 07C.
W71-13858

UPPER RIFLE RIVER BASIN NORTHEASTERN LOWER MICHIGAN,
Geological Survey, Lansing, Mich.
For primary bibliographic entry see Field 02E.
W71-13859

GERMANIUM IN IRON-MANGANESE CONCRETIONS OF RECENT SEDIMENTS (Germaniy v zhelezo-margantsevykh konkretsiyakh sovremennykh osadkov),
Akademiya Nauk SSSR, Gelendzhik. Institut Okeanologii.
For primary bibliographic entry see Field 02J.
W71-13860

SUBSURFACE DRAINAGE OF CHEMICALS IN THE USSR (Podzemnyy khimicheskiy stok na territorii SSSR),
Akademiya Nauk SSSR, Moscow. Geologicheskii Institut.
For primary bibliographic entry see Field 02F.
W71-13861

SELENIUM IN RECENT BLACK SEA SEDIMENTS (Selen v sovremennykh osadkakh Chernogo morya),
Akademiya Nauk SSSR, Gelendzhik. Institut Okeanologii.
For primary bibliographic entry see Field 02J.
W71-13865

SALINE LAKES OF THE EASTERN PAMIRS AS CONCENTRATORS OF RARE ELEMENTS (Solyanyye ozera Vostochnogo Pamira--kontsentratory redkikh elementov),
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 02H.
W71-13866

INVESTIGATIONS OF FERRUGINOUS BAUXITE AND OTHER MINERAL RESOURCES ON KAUAI AND A RECONNAISSANCE OF FERRUGINOUS BAUXITE DEPOSITS ON MAUI, HAWAII,
Geological Survey, Washington, D.C.
S. H. Patterson.
Available from SOD, GPO, Wash, D.C., Price $2.50. Geological Survey Professional Paper 656, 1971. 74 p, 15 fig, 11 plate, 17 tab, 103 ref.

Descriptors: *Water chemistry, *Hydrogeology, *Mineralogy, *Volcanoes, *Hawaii, Geochemistry, Water properties.
Identifiers: *Ferruginous bauxite deposits.

Low-grade ferruginous bauxite deposits occur in the eastern part of Kauai, Hawaii. The bauxite has formed by weathering of basalt of the Koloa Volcanic Series. The deposits underlie old lava flow surfaces in interstream uplands. The bauxite consists chiefly of gibbsite, goethite, hematite, and titaniferous magnetite and contains minor halloysite-metahalloysite. Resources of ferruginous bauxite on Kauai are estimated to be 110 million. Bauxite and saprolite formed by weathering of basalts chiefly by leaching by downward-percolating water. Water in weathered rocks ranges in pH from 4.0 to 5.9 and contains very little dissolved material. Water in fresh rock is higher in pH and contains significant quantities of dissolved silica, alkalies, and alkaline earths. Ferruginous bauxite deposits in West Maui have formed on the Honolua Volcanic Series, and those in East Maui, on the Kula Volcanic Series. Deposits in East Maui contain an estimated 22 million tons and deposits in West Maui contain about 9 million tons of bauxite. (Woodard-USGS)
W71-13870

THE ANALYSIS OF LEAD AND ZINC IN NATURAL WATERS BY THE 'SAMPLING BOAT' TECHNIQUE,
Missouri Univ., Rolla, Dept. of Geology.
For primary bibliographic entry see Field 05A.
W71-13907

WATER QUALITY INVESTIGATION, PART II-BASIC DATA, FORT LOUDOUN RESERVOIR, JUNE 1968-DECEMBER 1970.
Tennessee Univ., Knoxville. Water Resources Research Center.
For primary bibliographic entry see Field 02H.
W71-13908

CLAY MINERAL COMPOSITION AND GEOLOGIC SIGNIFICANCE OF SOME BEAUFORT SEA SEDIMENTS,
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 02J.

W71-13922

DOLOMITE, PHOSPHORITE, AND CARBONATE DIAGENESIS ON A CARIBBEAN SEAMOUNT,
Bedford Inst., Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
J. L. Marlowe.
Journal of Sedimentary Petrology, Vol 41, No 3, p 809-827, September 1971. 9 fig, 2 tab, 49 ref.

Descriptors: *Diagenesis, *Carbonate rocks, *Sedimentation, Water chemistry, Chemical precipitation, Mineralogy, Phosphates, Calcite, Dolomite.
Identifiers: *Caribbean Sea, *Seamounts.

Carbonate rocks consisting of micritic phosphorite, reefoid conglomerate and calcarenite were dredged from a seamount on Aves Swell, in the Caribbean Sea. These rocks were investigated by optical, chemical, X-ray diffraction, and electron microprobe techniques in order to study the effects of diagenesis. Samples of micritic phosphorite were dense and hard, contained Oligocene-Miocene foraminiferal remains and were composed dominantly of microcrystalline carbonate-apatite. They formed by replacement of an original calcareous ooze. Conglomerate composed of highly altered reef detritus with fossils of probable Pleistocene to early Holocene age was collected in the depth range of 340 to 455 m. The rock has been paritally replaced by carbonate-apatite and iron/manganese oxides, with many dolomite euhedra. Fragments of high-magnesium calcite may have served as nuclei for the development of dolomite. It does not appear likely that the dolomite formed at shallow depths. Porous calcarenite composed dominantly of shell fragments and cemented by calcite was collected from the top of the seamount, at 340 m. This rock has not been exposed to the effects of atmospheric water. Cementation probably took place below sea level. (Knapp-USGS)
W71-13927

THE GENESIS OF SOME SIDERITIC BEDS IN THE YORKSHIRE LIAS (ENGLAND),
Oxford Univ. (England). Dept. of Geology and Mineralogy.
For primary bibliographic entry see Field 02J.
W71-13931

2L. Estuaries

CONTRIBUTION TO THE ECOLOGICAL AND BIOLOGICAL STUDY OF THE LE GAPEAU RIVER (VAR),
Aix-Marseille Univ. (France). Faculte des Sciences.
A. Kiener, and J. Ollier.
Hydrobiologia. 36 (2): 189-251, Illus, Maps, 1970 (Engl and Ger summ).
Identifiers: Biological, Ecological, Ecology, Fauna, France, Gapeau, Le, River.

This study emphasizes the ecological and faunistic aspects of the coastal Mediterranean river Le Gapeau (Var). Among diverse tributaries, a little Torrential river, Le Latay, geographically extends the course of the Gapeau into low mountain region. The freshwater portion can be divided into 5 zones and 2 other zones constitute the estuary with brackish waters. A brief comparison with other coastal Mediterranean rivers is made.--Copyright 1971, Biological Abstracts, Inc.
W71-13115

ANIMAL - SEDIMENT RELATIONSHIPS IN WELLINGTON HARBOUR,
J. L. McKoy.
Bull Natur Sci (Wellington). 1: 5-20, Illus, Map, 1970.
Identifiers: Animal, Harbour, New-Zealand, Relationships, Sediment, Wellington.

Evidence for a relationship between the animals and the sediments in selected areas in Wellington Harbour is presented. Optimum habitats for filter feeders, deposit feeders, and carnivores are sandy mud, silty mud and very sandy mud respectively.--Copyright 1971, Biological Abstracts, Inc.
W71-13117

EFFICIENCY OF THE REVERSE-FLOW FILTER TECHNIQUE FOR CONCENTRATION OF PARTICULATE MATTER,
California Univ., San Diego. Inst. of Marine Resources.
For primary bibliographic entry see Field 07B.
W71-13120

BIOGEOCHEMISTRY OF THE STABLE ISOTOPES OF HYDROGEN AND CARBON IN SALT MARSH BIOTA,
Texas Univ., Austin. Dept. of Botany.
Bruce N. Smith, and Samuel Epstein.
Plant Physiol. 46 (5): 738-742. Illus. 1970.
Identifiers: Bio, Biota, Carbon, Fractionation, Geochemistry, Herbivore, Hydrogen, Isotopes, Marsh, Plant, Salt, Species, Stable, Tissues.

Deuterium to H ratios of 14 plant spp. from a salt marsh and lagoon were 55% depleted in deuterium relative to the environmental water. Carbon tetrachloride-extractable material from these plants was another 92% depleted in deuterium. This gave a fractionation factor from water to CCl4 extract of 1.147. This over-all fractionation was remarkably constant for all species analyzed. Plants also discriminate against 13C, particularly in the lipid fraction. Data suggest that different mechanisms for C fixation result in different fractionations of the C isotopes. Herbivore tissues reflected the isotopic ratios of plants ingested. Apparently different metabolic processes are responsible for the different degrees of fractionation observed for H and C isotopes.--Copyright 1971, Biological Abstracts, Inc.
W71-13121

A STUDY OF AN ESTUARINE LAGOON WITH PARTICULAR REFERENCE TO CORDYLOPHORA LACUSTRIS ALLMAN,
Memorial Univ. of Newfoundland. St. John's. Dept. of Biology.
T. F. Mace, and G. O. Mackie.
Can J Zool. 48 (6): 1454-1456. 1970.
Identifiers: Abundance, Copepod, Cordylophora-Lacustris, Diptera, Estuarine, Food, Lagoon, Phyto, Plankton, Ruppia-Maritima-M, Seasonal, Zoo.

A physical and biological study of a brackish water lagoon near Victoria, British Columbia, was conducted during the spring and summer of 1969. Variations in salinity and water temperature were correlated with variations in weather conditions. The phytoplankton and zooplankton were composed of freshwater and marine forms. Wild C. lacustris colonies were also observed in this period. The colonies occurred in equal numbers on 2 different substrates, the surfaces of submerged wood, and the weed Ruppia maritima. Analysis of the coelenteric contents of animals that had previously fed indicates that C. lacustris feeds on dipteran larvae and planktonic copepods. Reproductive individuals were found between the middle of May and the middle of July, which the highest number observed about June 1.--Copyright 1971, Biological Abstracts, Inc.
W71-13122

AN ECOLOGICAL STUDY OF THE PRAWN FAUNA IN A TIDAL RIVER OF GODAVARI ESTUARY,
Central Inland Fisheries Research Inst., Barrackpore (India).
M. Subrahmanyam.
J Zool Soc India. 21 (1): 75-82. Illus. Map. 1969.
Identifiers: Crustaceans, Ecological, Estuary, Fauna, Godavari, India, Prawn, River, Salinity, Tidal.

Observations were made on the physical, chemical and biological changes that occurred in a tidal stream, when it was open and when it was partly cut off from the main estuary of the Gautami-Godavari River, during Nov. to June, 1960-61 and 1961-62. The salinity was low, the tidal currents were slow and the fauna, in particular the crustaceans, was poor at the Gautami-end of the Coringa River when it was partly closed. The conditions returned to normal during the same period in 1962-63.--Copyright 1971, Biological Abstracts, Inc.
W71-13123

DISSOLVED PHOSPHORUS CONCENTRATIONS IN A NATURAL SALT-MARSH OF DELAWARE,
Univ. Ga., Mar. Inst., Sapelo Island, Ga., 31327, Georgia Univ., Sapelo Island. Marine Inst.
Robert J. Reimold, and Franklin C. Daiber.
Hydrobiologia. 36 (3/4): 361-371. Illus. 1970, (Fr. summ.).
Identifiers: Delaware, Dissolved, Marsh, Natural, Phosphorus, Salt, Seasonal, USA, Variations.

Dissolved P concentrations, salinity, pH, and related physical parameters were used to evaluate the variations in a natural salt-marsh. Diel, tidal, lunar, and seasonal variations in P concentrations were evaluated for a 3 yr period in a natural marsh, situated along the southwestern coast of the Delaware Estuary. Seasonal concentrations of dissolved P reached a maximum during the summer months (150 microgram at .1-1) and a minimum during the winter months (10 microgram at.1-1). An equation representing the relationship of the measured parameters to the dissolved P concentrations is presented. Several mechanisms are postulated to explain the seasonal fluctuations in the P concentrations.--Copyright 1971, Biological Abstracts, Inc.
W71-13124

MINIMUM AND MAXIMUM DISTRIBUTION OF SPECIES IN WATERS OF VARIOUS SALINITY,
Akademiya Nauk SSSR, Leningrad. Zoologicheskii Institut.
L. L. Chislenko.
Gidrobiol Zh. 6 (1): 65-70. Illus. 1970.
Identifiers: Distribution, Faunal, Maximum, Minimum, Salinity, Species, Waters.

The relative distribution of faunal species in relation to fresh, brackish and marine water regions were plotted and discussed based on a scheme by A. Remane which states that the minimum number of fresh and saltwater species in saline regions is not at a salinity of 1.7% half-way between the values for oceanic and freshwater but is displaced towards freshwater at values between 0.5-0.8%.--Copyright 1971, Biological Abstracts, Inc.
W71-13125

POLLUTION: AN INTERNATIONAL PROBLEM NEEDING INTERNATIONAL SOLUTION,
Supreme Court, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-13201

OPTIMIZATION OF WATER ALLOCATION DECISIONS AFFECTING ESTUARINE ECOLOGY,
Colorado School of Mines, Golden. Dept. of Mathematics.
For primary bibliographic entry see Field 06A.
W71-13215

APPLICATIONS OF POLYMERS IN MARINE ECOLOGY,
Bologna Univ. (Italy). Ciamician Chemical Inst.
For primary bibliographic entry see Field 05A.
W71-13232

THE FACTORS LIMITING REALIZATION OF THE FULL POTENTIAL OF RESOURCES OF THE COASTAL ZONE,
Bureau of Commercial Fisheries, Woods Hole, Mass.
For primary bibliographic entry see Field 05C.
W71-13245

COMMERCIAL AND RECREATIONAL FISHERY RESOURCES OF ESTUARINE WATERS, SOUTHERN UNITED STATES,
Miami Univ., Fla. Rosenstiel School of Marine and Atmospheric Science.
For primary bibliographic entry see Field 05C.
W71-13248

THE CONSERVATION OF MARINE SPECIES AND AREAS,
Smithsonian Institution, Washington, D.C. Office of Environmental Sciences.
For primary bibliographic entry see Field 05C.
W71-13249

PATTERNS OF DISTRIBUTION OF COASTAL BIOTA, REMOTE SENSING, AND CONSERVATION OF RESOURCES,
Virginia Univ., Charlottesville. Dept. of Environmental Science.
For primary bibliographic entry see Field 05C.
W71-13254

MARINE BIORESOURCES - DEPENDENCE UPON ENVIRONMENTAL QUALITY,
Environmental Research and Applications, Inc.
For primary bibliographic entry see Field 05C.
W71-13265

A RIVER AS A CHEMICAL REACTOR,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13272

A DIGITAL COMPUTER TECHNIQUE FOR THE OPTIMAL CONTROL OF POLLUTANTS IN A CASCADED INPUT ESTUARY,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13273

THE HARMONIC ANALYSIS OF THE PENOBSCOT RIVER TIDES,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13274

DEVELOPMENT OF A WATER QUALITY CONTROL STRATEGY FOR RIVERS AND ESTUARIES USING HYBRID COMPUTER MODELING TECHNIQUES,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13280

INTERSTITIAL SILICA AND pH IN MARINE SEDIMENTS: SOME EFFECTS OF SAMPLING PROCEDURES,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
K. A. Fanning, and M. E. Q. Pilson.
Science, Vol 173, No 4003, p 1228-1231, Sept 24, 1971. 1 fig, 3 tab, 18 ref. NSF Grant GA-23414.

Descriptors: *Sediments, *Sampling, *Temperature, *Effects, Methodology, Sediment-water interfaces, Test procedures, Temperature control, Water chemistry, Hydrogen ion concentration, Silica, On-site tests, Water analysis, Analytical techniques.
Identifiers: *Marine sediments, Sampling procedures, Interstitial water.

Data are presented from experiments carried out to measure ways in which sampling procedures can alter the composition of interstitial water in marine sediments. The temperature at which water was squeezed from the sediment sample had a profound effect on the measured interstitial silica concentration which showed an average increase of 51% after the sediment was exposed to a temperature 20 deg C higher than in situ temperature. Similar effects were not found for interstitial phosphate or alkalinity, but the pH was slightly higher in the water squeezed at the higher temperature. These temperature-induced changes were completed in a few hours. Use of filter paper can significantly lower the pH of expressed pore waters. Until some important questions about temperature effects are answered, all future data on the pH and silica concentration of pore waters of marine sediments should be obtained from samples extracted at in situ temperatures. (Lang-USGS)
W71-13293

NATURAL OIL SEEPS IN OR NEAR THE MARINE ENVIRONMENT: A LITERATURE SURVEY,
Coast Guard, Washington, D.C. Applied Chemical Oceanography Branch.
For primary bibliographic entry see Field 05B.
W71-13297

CARBONATES IN BLACK SEA BOTTOM SEDIMENTS (Karbonaty v donnykh otlozheniyakh Chernogo morya),
Akademiya Nauk SSSR, Moscow. Geologicheskii Institut.
For primary bibliographic entry see Field 02J.
W71-13298

DISTRIBUTION OF RADIONUCLIDES IN BOTTOM SEDIMENTS OF THE COLUMBIA RIVER ESTUARY,
Geological Survey, Washington, Oreg.
For primary bibliographic entry see Field 05B.
W71-13378

PLANKTON AND NUTRIENT ECOLOGY OF THE COLUMBIA RIVER ESTUARY,
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 05C.
W71-13382

PLANT NUTRIENTS AND THE ESTUARY MECHANISM IN THE DUWAMISH RIVER ESTUARY, SEATTLE, WASHINGTON,
Geological Survey, Tacoma, Wash.
L. J. Tilley, and W. A. Dawson.
GPO, Washington, DC 20402 - Price $2.75. Geological Survey Research 1971, Chapter C, Professional Paper 750-C, p C185-C191, 1971. 4 fig, 4 tab, 5 ref.

Descriptors: *Estuaries, *Nutrients, *Path of pollutants, *Washington, *Saline water intrusion, Stratified flow, Salinity, Density stratification, Waste water disposal, Ammonia, Sedimentation, Washington.
Identifiers: *Duwamish Estuary (Wash), Seattle (Wash).

The Duwamish River estuary, Washington, traps plant nutrients in the water of its alt wedge. Analyses of input and output of nutrient concentrations in the estuary show a nearly twofold increase in concentrations of nutrients in the salt wedge. The increase consists of nutrients transferred from the outflowing river wate in amounts which barely affect river-water concentrations. (Knapp-USGS)
W71-13459

TSUNAMI-RESPONSES OF SAN PEDRO BAY AND SHELF, CALIFORNIA,
Basil W. Wilson.
ASCE Proceedings, Journal of the Waterways, Harbors and Coastal Engineering Division, Vol 97, No WW 2, Paper 8107, p 239-258, May 1971. 12 fig, 5 tab, 27 ref.DACW 09-67-C-0065, Army Corps of Engineers.

Descriptors: *Seiches, *Tsunamis, *Continental shelf, *Bays, *California, Tides, Tidal effects, Ocean waves, Waves (Water), Seismic design, Surges.
Identifiers: San Pedro Bay (Cal).

The lowest modes of free oscillation of the continental shelf off San Pedro Bay, California, were determined analytically from geometric models which approximate the shelf as the sector of a cone overlying a vertical-convex circular-cylindrical continental slope. The shelf was also modeled as a sloping basin coupled with the deep San Pedro Channel between the Santa Catalina Island and the mainland. The lowest modes of oscillation of the adjacent oceanic basins most likely to affect San Pedro Bay were also determined by modeling them geometrically as open-mouth, semi-ellipsoidal (Gulf of Santa Catalina) and closed, ellipsoidal (Santa Cruz Basin to Gulf of Santa Catalina) shapes. Marigrams from several tide-stations in Los Angeles-Long Beach Harbors, which recorded the tsunamis of November 11, 1922 (Chile), April 1, 1946 (Aleutian Trench), May 23, 1960 (Chile) and March 28, 1964 (Alaska), were analyzed for their power spectra and reveal numerous peaks of high energy recurrent at the widely separated times. These periods of resonance agree quite closely with many of the calculated periods of free oscillations. (Knapp-USGS)
W71-13506

THE ECONOMICS OF SEWAGE DISPOSAL IN A COASTAL URBAN AREA-A CASE STUDY OF THE MONTEREY PENINSULA, CALIFORNIA,
California Univ., Berkely. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 05G.
W71-13605

THE DISTRIBUTION AND MOVEMENT OF SEDIMENT IN THE SOLENT, SOUTHERN ENGLAND,
Southampton Univ. (England). Dept. of Oceanography.
K. R. Dyer.
Marine Geology, Vol 11, No 3, p 175-187, October 1971. 7 fig, 1 tab, 8 ref.

Descriptors: *Sediment transport, *Estuaries, *Tidal effects, Sounding, Sampling, Sedimentation, Deposition (Sediments), Sedimentary structures, Provenance, Dunes, Regime, Channel morphology, Meanders, Eddies, Distribution patterns.
Identifiers: *Solent estuary (England).

Echo sounding, oblique Asdic surveying, and sampling shows the Solent estuary, England to be extensively floored by gravel dunes. The dune asymmetry and the sediment distribution indicates transport eastwards from the principal source at Hurst Spit, with recirculating eddies within the Solent. Current measurements show that the water flow meanders and that the recirculating eddies of sediment are associated with the positions of the meanders. The observed sediment distribution when compared with that predicted from the water flow shows that the gravel is often oversaturated with sand where currents are equal and opposite. Where the currents are asymmetrical the gravel is undersaturated with sand. Modified scree slopes appear where abrupt changes in the direction of sediment movement occur. (Knapp-USGS)
W71-13610

WIND WAVE CHARACTERISTICS IN DEEP AND SHALLOW PARTS OF A BAY,
For primary bibliographic entry see Field 02E.
W71-13616

WATER POLLUTION IN THE GREATER NEW YORK AREA-SYMPOSIUM.
For primary bibliographic entry see Field 05B.
W71-13624

SOME COMMENTS ON THE FACTORS INFLUENCING THE SPREAD OF POLLUTANTS IN SHELF WATERS,
Lamont-Doherty Geological Observatory, Palisades, N.Y.
For primary bibliographic entry see Field 05B.
W71-13626

COASTAL-ZONE GEOLOGY AND ITS RELATIONSHIP TO WATER POLLUTION PROBLEMS,
Barnard Coll., New York. Dept. of Geology and Geography.
For primary bibliographic entry see Field 05B.
W71-13627

GROSS PHYSICAL AND BIOLOGICAL EFFECTS OF OVERBOARD SPOIL DISPOSAL IN UPPER CHESAPEAKE BAY,
Chesapeake Biological Lab. Solomons, Md.
For primary bibliographic entry see Field 05C.
W71-13721

LIFE AND DEATH OF THE SALT MARSH,
Woods Hole Oceanographic Institution, Mass.
J. Teal and M. Teal.
Little, Brown and Co., Boston, Massachusetts, 1969. 278 p.

Descriptors: *Ecosystems, *Salt marshes, *Marsh plants, Marsh management, Tidal marshes, Aquatic environment, Land reclamation, Drainage effects, Mosquitos, Geology, Water pollution effects.

The salt marshes of the East Coast of North America are examined in detail. Chapters explain how the marshes were formed, why they continue to exist, the ecological interplay between plants and animals, and the effect of man on the ecosystem. (Currer-PAI)
W71-13724

EROS AS A TOOL IN COASTAL ZONE MANAGEMENT,
Department of Natural Resources, Washington, D.C. Surveys and Marine Management Div.
For primary bibliographic entry see Field 07B.
W71-13727

POLLUTION MANAGEMENT IN THE COASTAL STATES,
Ocean Science Center of the Atlantic Commission, Savannah, Ga.
For primary bibliographic entry see Field 05G.
W71-13728

COMPREHENSIVE FRAMEWORK PLANNING IN THE COASTAL ZONE,
Center for the Environment and Man, Inc., Hartford Conn.
For primary bibliographic entry see Field 06B.
W71-13729

THE NECESSITY OF LOCAL SUPPORT IN COASTAL ZONE PLANNING,
Interstate Electronics Corp; Anaheim, Calif. Oceanics Div.
For primary bibliographic entry see Field 06B.
W71-13730

AN ANALYTICAL PROCEDURE FOR COASTAL ZONE ALLOCATION DECISIONS,
Gulf Universities Research Corp., Galveston, Tex.
T. W. Bilhorn and J. M. Sharp.
In: Marine Technology Society 7th Annual Conference, August 16-18, 1971, Washington, D.C., p 453-471. 5 fig.

Descriptors: *Estuaries, *Estuarine fisheries, *Analytical techniques, Economics, Water demand, Water requirements, Income analysis.
Identifiers: *Functional and Dependency relationships, Income dependency coefficients, Matrix equations, Coastal zone allocation.

Because of the lack of services necessary for the prediction of estuarine and other coastal or near shore processes, statistics are not available for the determination of the value, or cost/benefit comparisons, of such services. A rationale and procedure was developed whereby expert opinion can be used in lieu of statistical treatment. Based on a definition of the services to be provided, the environmental processes which would be quantitatively predicted, and the dependency of major estuarine-dependent income sources on such environmental prediction, a matrix of income dependency coefficients is derived for the case of physical processes in Gulf Coast estuaries. The basic rationale and procedure are adaptable to a broader ranger of coastal zone management problems. (Currer-PAI)
W71-13731

OCEAN ISLANDS -- ROSETTA STONES FOR COASTAL CITIES,
Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 06B.
W71-13732

URBAN IMPACTS ON COASTAL ZONE MANAGEMENT,
Coastal Zone Resources Corp., Muskegon, Mich.
For primary bibliographic entry see Field 06B.
W71-13733

ECONOMIC TOOLS FOR EVALUATING COASTAL DEVELOPMENT: THE CHESAPEAKE BAY ENIGMA,
Johns Hopkins Univ., Baltimore, Md.
For primary bibliographic entry see Field 06B.
W71-13735

EFFECTS OF ORGANIC ENRICHMENT ON BENTHIC FAUNA IN A TIDAL RIVER,
Raytheon Environmental Research Lab., New London, Conn.
For primary bibliographic entry see Field 05C.
W71-13737

EVALUATION OF WASTE DISPERSION IN ESTUARIES USING FLUORESCENT TRACER DYE,
Raytheon Environmental Research Lab., New London, Conn.
For primary bibliographic entry see Field 05B.
W71-13738

EVALUATION OF ESTUARINE CIRCULATION BY AERIAL PHOTOGRAPHY OF CURRENT DROGUES,
Raytheon Environmental Research Lab., New London, Conn.
For primary bibliographic entry see Field 05B.
W71-13740

ELEMENTS OF OCEANS AND COASTAL ZONE MANAGEMENT,
California State Advisory Commission on Marine and Coastal Resources, Sacramento.
R. B. Kreuger.
Under Sea Technology, July 1971, p 37-40.

Descriptors: *Water resources development, *Legislation, *Federal government, Administrative agencies, Land use, Regulation, Pollution abatement, Environmental engineering, Estuarine environment.
Identifiers: *Coastal zone management, *Oceans management systems, River and Harbors Act of 1899, Environmental Protection Agency.

Coastal zone management is examined at the global and Federal level. The essentials of a global ocean management system is given and the major obstacles to the implementation of such a plan are cited. The history of Federal coastal zone management, beginning with the 1899 River and Harbors Act, is detailed, and recent pertinent legislation is described. (Currer-PAI)
W71-13750

EVIDENCE OF HYPERPLASIA IN AN ESTUARINE BRYOZOAN ATTRIBUTABLE TO COAL TAR DERIVATIVES,
National Museum of Natural Sciences, Ottawa (Ontario).
For primary bibliographic entry see Field 05G.
W71-13763

DEPOSITIONAL STRUCTURES AND PROCESSES IN THE NON-BARRED HIGH-ENERGY NEARSHORE,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02J.
W71-13919

POLYGONAL PATTERNS IN MUDDY TIDAL FLATS,
Department of the Environment, Sainte-Foy (Quebec).
J. C. Dionne.
Journal of Sedimentary Petrology, Vol 41, No 3, p 838-839, September 1971. 4 fig, 9 ref. NSF Grant GP-479.

Descriptors: *Sedimentary structures, *Ice, *Ice breakup, *Tidal marshes, *Mud flats, Tidal effects, Mud-water interfaces, Sedimentation, Bottom sediments, Melting.
Identifiers: *St. Lawrence River, Polygonal ridges (Mud).

In the spring polygonal mud ridges develop in muddy tidal flats along the south shore of the middle St. Lawrence Estuary, Quebec. They result from the squeezing of soft mud into the icefood tidal cracks under load pressure related to tidal movements. Dimensions, shape, nature of sediments involved, absence of any trace of crack filling, as well as absence of a network of small-sized polygons within the large ones, are good criteria for distinguishing between typical ice-made polygonal ridges from frost and desiccation polygonal patterns. However, it is possible that two different series of polygons develop in the same unit in a given area. (Knapp-USGS)
W71-13929

GEOLOGIC SIGNIFICANCE OF MICROBORING FUNGI AND ALGAE IN CAROLINA SHELF SEDIMENTS,
Duke Univ, Durham, N.C. Dept. of Geology.
For primary bibliographic entry see Field 02J.
W71-13930

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

WATER--THE DEPARTMENT OF THE INTERIOR'S SYSTEMATIC MANAGEMENT OF A RESOURCE,
Department of the Interior, Washington, D.C. Water Quality and Research.
S. Fred Singer.

Geological Problems in Lunar and Planetary Research, p 699-714, January 1968. 1 tab, 1 ref.

Descriptors: *Water resources development, *Water supply, *Water reuse, *Desalination, *Weather modification, *Inter-basin transfers, Planning, Water management, Water storage, Water demand, Icebergs, Feasibility studies, Precipitation (Atmospheric), Pilot plants.
Identifiers: Water research, Project Skywater, Precipitation control, Basic research.

The responsibility of managing the United States' water supply lies with the Department of the Interior. The country's water supply, though strained by population growth and unprecedented demands of technological progress, is adequate if managed properly. The problem lies in the maldistribution of natural water resources in relation to population concentrations. Re-use of water in closed cycles is a proposed method increasing the supply and preventing pollution. The Office of Saline Water is operating pilot nuclear desalting plants that offer a promising low cost competitive water supply and in addition electric power. The Bureau of Reclamation provides irrigation water and improved management techniques for the semi-arid West and is studying the possible inter-basin transfer of Mississippi River water to West Texas. Project Skywater is investigating weather modification through precipitation control. The Office of Water Resources Research administers the Water Resources Research Act of 1964 which supplies research grants to 51 water resources research institutes throughout the country. (Wade-Wisconsin)
W71-13189

SOME CONJUNCTIVE DESALTING STUDIES IN THE UNITED KINGDOM,
Water Research Association, Marlow (England). Economics Group.
For primary bibliographic entry see Field 06A.
W71-13217

A COMPUTER SIMULATION PROGRAM FOR OPTIMIZING CONJUNCTIVE OPERATION OF DESALTING PLANTS,
Hill (Clair A.) and Associates, Redding, Calif.
For primary bibliographic entry see Field 06A.
W71-13219

THE INFLUENCE OF HYDROXYL RATIO ON THE PERFORMANCE OF REVERSE OSMOSIS DESALINATION MEMBRANES,
Celanese Research, Summit, N.J.
Frank S. Model, Howard J. Davis, Abraham A. Boom, Cecil Helfgott, and Leonard A. Lee.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, Price $1.25. Office of Saline Water Research and Development Progress Report No 657, March 1971. 130 p, 34 tab, 11 fig, 35 ref. OSW Contract 14-01-0001-1724.

Descriptors: *Reverse osmosis, *Membranes, *Desalination, Osmosis, Evaporation, Cellulose, Membrane processes.
Identifiers: Acetyl values, Hydroxyl ratios, Casting speed, *Loeb-membranes, Cellulose acetate.

A study has been carried out of chemical and physical variables associated with the preparation of Loeb-type cellulose acetate reverse osmosis membranes and the effect of these variables on membrane performance criteria. The major objective has been to investigate the influence of systemically varied primary-to-secondary free hydroxyl ratio in cellulose acetate polymer samples. It has been shown that a primary-to-secondary ratio of about 0.65 (higher than that found in commercially available cellulose acetates) is optimal. Coupled with a preferred acetyl value of about 55.5 these high primary hydroxyl cellulose acetate variants yield membranes with the best desalination performance in terms of flux at salt rejection rates of 90% or better. In addition to the marked effect of these two variables, hydroxyl ratio and acetyl value, there is evidence that molecular weights around 40,000 are desirable. (Horowitz-OSW)
W71-13470

OPERATION OF THE MULTI-EFFECT MULTI-STAGE FLASH DISTILLATION PLANT (CLAIR ENGLE), THIRD REPORT (ANNUAL), SAN DIEGO, CALIFORNIA.
Catalytic, Inc., Philadelphia, Pa.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price $6.50. Office of Saline Water Research and Development Progress Report No 668, April 1971. 500 p, 105 fig, 74 tab, 14 append. OSW Contract 14-01-0001-2283.

Descriptors: *Operations and maintenance, Management, *Flash distillation, *Desalination, *Desalination equipment, Heat exchangers, Pumps, Corrosion, Waste water treatment, Deaeration, Evaporators, Operating costs, Design, Scaling, Temperature, California.
Identifiers: San Diego (Calif).

A general discussion is presented concerning the management operation, maintenance, physical plant, and information gained in the overall program of advancing the state of the are of desalting technology. The plant is a 1,000,000 gallon per day, high performance, sea water desalination plant. The plant is designed to provide meaningful data concerning the design and operation of large desalination plants including such items as heat transfer, equipment and structural design, materials, cost of providing fresh water, process engineering including high temperature operation, operation of multi purpose plants, and equipment performance. (Lohman-OSW)
W71-13471

ADVANCED REVERSE OSMOSIS-MEMBRANE MODULE SYSTEMS,
Philco-Ford Corp., Newport Beach, Calif. Aeroneutronic Div.
J. L. Richardson, G. Segovia, J. W. Mason, and W. J. Subcasky.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, Price $2.00. Office of Saline Water Research and Development Progress Report No 661, May 1971. 237 p, 83 fig, 54 tab, 24 ref. OSW Contract 14-01-0001-2206.

Descriptors: *Reverse osmosis, *Desalination, *Membrane processes, *Membranes, Saline water, Permselective membranes, Separation techniques, Osmosis, Design.
Identifiers: *Tubular membranes, Continuous membrane casting, Feed additives, Flexible membrane supports, Continuous membrane casting apparatus.

The basic elements of a new tubular reverse osmosis module design approach, characterized by a potential for low cost, have been derived from a research investigation of continuous casting and flexible braided sleeve membrane pressure supports. Techniques were developed for batch casting 1/4 inch by 20 foot long membranes, and the results were used along with viscoelastic property determinations of selected casting solutions and pressure drop prediction for annular extrusion in order to define the principal characteristics of a continuous casting apparatus. The apparatus proved to be capable of producing tubular membrane whose properties were essentially constant in the longitudinal direction while the length of produced tubing was limited only by the length of the tapes used to form a smooth, moving casting surface. The performance of the continuous casting apparatus was demonstrated at casting rates up to 2/3 foot/minute. A continuing investigation into the effectiveness of selected surface-active species used as feed additives for improving the salt rejection characteristics of membranes was completed. (Kindley-OSW)
W71-13472

PRODUCTION OF BIMETALLIC TUBING FOR FLASH DISTILLATION PLANTS,
Tyco, Louisville, Colo. Explosive Fabricators Div.
K. R. Agricola.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price $0.50. Office of Saline Water R and D Report No 686, July 1971. 51 p, 22 fig, 4 tab. OSW Contract No 14-30-2595.

Descriptors: *Tubes, *Stainless steel, *Explosives, Fabrication, Cost analysis, Heat exchangers, Distillation, Bonding.
Identifiers: Composite tubing.

Explosive bonding or cladding is one of the most promising techniques for producing a solid-state junction between two dissimilar metals or alloys. The resultant clad product is as strong as the weaker of the two materials and is free of any heat effects which result from any fusion joining process. The cladding of the bore of 316 stainless steel tubing with 90-10 cupro-nickel tubing was accomplished under controlled off-site explosive operations. The explosively-welded bimetallic tube billet, 3-1/4 inches O. D. by .310 inches wall was then subsequently reduced to a final bimetallic tube size of 3/4 inches O. D. by .035 inches wall by conventional tube reduction and drawing techniques. In this manner, metallurgically bonded bimetallic tubing can be produced for utilization in flash distillation plants where the operational environment requires the use of such a product. The application of explosive cladding to the fabrication of bimetallic tubing and the evaluation of this tubular product are discussed in sufficient detail to allow for an accurate assessment. (Effenberger-OSW)
W71-13473

TRANSPORT-DEPLETION DESALINATION PILOT PLANT,
Pratt and Whitney Aircraft, East Hartford, Conn.
Ralph Redman.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price $2.75. Office of Saline Water R and D Progress Report No 683, April 1971. 185 p, 161 fig, 23 tab. OSW Contract No 14-01-0001-1262.

Descriptors: *Desalination, *Desalination processes, *Electrodialysis, *Transport-depletion, Membrane processes, Pilot plants.

Data on transport-depletion processes were reviewed prior to bench-scale evaluation to determine suitable conditions for optimum stack performance. The conditions necessary to achieve optimum performance included higher solution velocities, smaller membrane spacing and longer path length. The stack design chosen for the pilot plant consisted of a forty-cell-pair plate-and-frame design with four separate channels. The path lengths were variable, and the membrane space was 30 mils. Testing of the forty-cell-pair stack covered a range of variables, and gave current efficiencies of 36 to 70% and product concentrations as low as 120 ppm (3,000 ppm NaCl feed). A design and cost study of a 500,000 gpd transport-depletion test-bed plant was also performed. (Mintz-OSW)
W71-13474

DISTILLATION PLANT DATA BOOK,
Houston Research, Inc., Tex.
A. E. Dukler, L. C. Elliott, and A. L. Farber.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price $2.75. Final Report January 1971. 181 p, 56 fig, 143 ref. OSW Contract No 14-01-0001-2099.

Descriptors: *Flash distillation, *Deaeration, *Distillation, *Corrosion, Physical properties, Carbon dioxide, Fabrication, *Evaporation, Films, Water treatment, Tubes, Scaling, Evaporators.
Identifiers: Feedwater treatment, Vertical tube evaporators, Venting, Pasification, Steam jet ejectors.

A discussion of the more important parameters required for the design or evaluation of VTE and MSF distillation plants is provided. It is directed primarily toward individuals in the desalting industry including the design engineer, the operating engineer and the owner. Major sections of the book are Glossary, Process Design of Multistage Flash Evaporators, Process Design of Vertical Tube Evaporators, Process Design Common to Both Evaporative Processes, Sea Water Pretreatment, Mechanical Design and Material Selection, and Physical Property Data. (Robinson-OSW)
W71-13475

SPECIAL REPORT ON STATUS OF DESALTING COMPREHENSIVE FRAMEWORK STUDY,
Oak Ridge National Lab., Tenn.
Irving Spiewak.
Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402. $1.00. Office of Saline Water Technical Report, November 1970. 111 p, 32 fig, 8 tab, 35 ref. OSW Contract 2535, Work Order 18.

Descriptors: *Reviews, *Membrane processes, *Distillation, *Freeze processes, *Southwest United States, Dialysis, Osmosis, Desalination processes, Vapor compression distillation, Evaporators.

This state-of-the-art survey is intended to give water resource engineers a background in desalting technology and costs. Particular emphasis is given to systems which should be considered for solution of water resource problems in the Pacific Southwest. Desalted water cost estimates are given for present and anticipated technology in distillation processes, membrane processes and vacuum freezing. Multistage flash vertical-tube evaporator, vapor compression, electrodialysis, reverse osmosis and vacuum freezing processes are described, their commercial and developmental status given, feed treatment and brine disposal problems discussed, and siting and environmental constraints described. A discussion of nuclear power plants for supply of steam for desalting is given. (Spiewak-OSW)
W71-13476

USE OF IMPROVED MEMBRANES IN TERTIARY TREATMENT BY REVERSE OSMOSIS,
McDonnell Douglas Corp., Newport Beach, Calif. Astropower Lab.
For primary bibliographic entry see Field 05D.
W71-13513

IONIC BLOCK COPOLYMERS AS PIEZODIALYSIS MEMBRANES,
Shell Oil Co., Emeryville, Calif.
G. Lopatin, H. A. Newey, E. T. Bishop, W. P. O'Neill, and A. B. Krewinghaus.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price $0.60. Office of Saline Water Research and Development Progress Report No 690, May 1971. 56 p, 11 tab, 17 fig, 24 ref. OSW Contract 14-01-0001-1826.

Descriptors: *Desalination processes, *Membrane process, *Dialysis, *Ion transport, *Ions, *Membranes.
Identifiers: *Pressure dialysis, Heterophase membranes, Charge mosaic membranes, *Cationic-anionic membranes.

Three types of ionic A-B-A block copolymers have been studied. These are (I) poly-styrene-polyisoprene-polystyrene copolymer with socium sulfonate groups attached to the rubbery center block, (II) polystyrene-polybutadiene-polystyrene with quaternary ammonium groups on the center block, and (III) polystyrene-ethylene propylene copolymer-polystyrene with sulfonate groups on the center block. Their properties and reverse osmosis behavior have been investigated towards their use as piezodialysis components and they were found to be very exceptional in strength, versatility and salt rejection. Based on these materials, two types of charge mosaic membranes were developed sufficiently for piezodialysis testing, and substantial salt enrichment of the effluent (piezodialysis) was observed. (Horowitz-Office of Saline Water)
W71-13991

EVALUATION OF NEWLY DEVELOPED ION-EXCHANGE MEMBRANES FOR ELECTRODIALYSIS AND/OR TRANSPORT DEPLETION,
General Electric Co., Lynn, Mass.
C. W. Plummer, J. Enos, A. B. LaConti, and J. R. Boyack.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Price $0.60. Office of Saline Water Research and Development Progress Report No 481, Dec 1969. 54 p, 19 tab, 10 fig.

Descriptors: *Electrodialysis, *Membrane processes, *Desalination processes, *Ion exchange, Separation techniques, Transport depletion, Membranes, Ion transport, Membranes.
Identifiers: *Fluorinated cationic membranes, *Bionic potential, Electrodialysis membranes.

Emphasis was placed on long-term elevated temperature evaluation of the fluorinated cationic membranes with respect to stability and performance during life tests in an electro-dialysis stack and the extensive determination of their mechanical, physical, chemical and transport properties. The performance of commercially available membranes (either cationic or anionic) as end compartment membranes was shown to be unsatisfactory at either low or high current densities, resulting in poor coulombic efficiencies and cross-membrane leakage. Their lack of sufficient electrochemical and chemical stability in the 70 deg C environment of the anode and cathode end compartments was found to be the cause of the poor performance and leakage. On the other hand, both types of fluorinated cationic membranes for end compartment use retained their activity and performance for reasonable lengths of time at both levels of current densities. The cost analysis which assumes the use of these membranes for end compartments, showed a distinct advantage over standard reported electrodialysis systems. Another important finding during the investigation was the unique ion selectivity properties displayed by one type of membrane during electrodialysis Webster water operation and bi-ionic potential measurements making them of interest for ion enrichment or depletion. (Kindley-Office of Saline Water)
W71-13992

RESEARCH ON IMPROVED REVERSE OSMOSIS MEMBRANES,
Gulf General Atomic Inc., San Diego, Calif.
H. K. Lonsdale, R. L. Riley, L. D. LaGrange, C. R. Lyons, and A. S. Douglas.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price $1.25. Office of Saline Water Research and Development Progress Report No. 484, December 1969. 120 p, 15 fig, 26 tab, 11 ref.

Descriptors: *Reverse osmosis, *Membranes, *Membrane processes, *Permselective membranes, *Desalination, Pressure, Semipermeable membranes, Saline water, Separation processes, Ion transport.
Identifiers: *Ultrathin membranes, *Composite membranes, Microporous supports, Polyacrylic acid, Cellulose nitrate-cellulose acetate supports, Compaction, Polyvinylpyrrolidone membranes.

Three principal areas of research and development were investigated. In the first of these, the development of thin-film composite membranes was pursued. The approach consists of applying ultrathin polymer films to a suitable porous support. Attention was focused on the development of methods for the semicontinuous production of porous cellulose ester membranes as thin-film supports. A casting device was assembled which allowed control of those parameters believed to be important in determining membrane properties. The importance of the membrane casting temperature was demonstrated, and cellulose nitrate-cellulose acetate (CN-CA) membranes were produced in 1 by 5 ft. sections that were used for preparing composites. Methods for coating the pores of the support membrane preparatory to depositing the thin salt-rejecting film were also examined. The technique studied in most detail was airless spraying of polyacrylic acid (PAA) from a dilute ethanol-water solution. A number of thin-film materials were deposited on these porous supports, including CAs, crosslinked polyvinylpyrrolidone (PVP), and modified ethyl cellulose. A second major subject of investigation was alternate membrane materials. A family of PVPs crosslinked with isocyanates was prepared which possessed a wide range of water and salt permeabilities. Extensive characterization of this polymer system was carried out using water sorption, direct osmosis, and reverse osmosis. A number of other polymer systems, including crosslinked polyvinyl alcohol and several polyurethane lattices, were examined in a less detailed manner. Finally, the phenomenon of compaction in modified CA and composite membranes was examined. Compaction rates were measured on membranes with different water permeabilities and different initial thicknesses in an attempt to distinguish between several proposed compaction mechanisms. A model of the compaction process is proposed in terms of the time-dependent porosity of the porous support membrane. The use of fillers to strengthen modified membranes and thereby arrest compaction was studied. (Kindley-Office of Saline Water)
W71-13993

WATER TECHNOLOGY II,
Nuclear Utilities Services, Pittsburgh, Pa. C. W. Rice Div.
Paul Goldstein, James K. Rice, Ronald M. Burd, and Robert E. Moore.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price $1.25. Office of Saline Water Research and Development Progress Report No. 679, April 1971. 137 p, 9 tab, 3 append. OSW Contract 14-30-2571.

Descriptors: *Desalination, *Waste water treatment, *Chemical removal, *Feed water treatment, *Microorganism control in water systems, Water softening, Deaeration, Ion exchange, pH control, Corrosion prevention, Reviews.
Identifiers: Well pipe corrosion, Analytical instrumentation, Boiler feed water treatment, *Chemical cleaning of brine heaters, Water well stimulation treatment, *Ion exchange resin cleaning.

Desalination plant water related technology encompasses may broad fields: engineering, biology, chemistry, physics, hydrology, corrosion, metallurgy and materials of construction. Application of these disciplines to current OSW operational programs covers water treatment to prevent organic and microbial fouling; desilicizing, ion exchange, reverse osmosis and membrane processes; corrosion preventive measures; inhibition of scale formation and scale removal from heat transfer surfaces; materials evaluation; environmental quality surveys; chemical and biological quality of raw and potable water; and protection of out-of-service equipment. (Dykstra-Office of Saline Water)
W71-13994

MOSAIC MEMBRANES FOR DESALINATION,
Research Triangle Inst., Durham, N.C. Camille Dreyfuss Lab.
A. Schindler, and H. Yasuda.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price $1.00. Office of Saline Water Research and Development Progress Report No. 689, May 1971. 105 p, 39 fig., 14 tab,. 54 ref. OSW Contract 14-01-0001-1785.

Descriptors: *Desalination processes, *Membrane processes, *Dialysis, *Ion transport.
Identifiers: *Pressure dialysis, *Heterophase membranes, *Charge Mosaic membranes, *Cationicanionic membranes.

Charge mosaic membranes are amphoteric membranes of composite structure, i.e., these membranes consist of small regions of anion selective material interspersed with small regions of cation selective material. In order to be useful in piezodialysis, each ionic region has to extend substantially uniformly from one surface of the membrane to the other one. For practical application the membranes must possess sufficient mechanical strength to withstand pressures up to 1600 psi. Three different approaches were investigated in the preparation of charge mosaic membranes, all of them being based on the incompatibility of different polymers. One of these films composed of sulfonated polystyrene and quaternized polyvinyl pyridine exhibited a very weak piezodialysis effect with an enrichment factor in the range of 1.03 to 1.05 at a feed concentration of 1.2 wt.-% NaCl (at 1000 psi). The low value of the enrichment factor was very likely a consequence of incomplete separation of both polyelectrolyte precursors due to their relatively high butadiene contents. Although ideal structures of charge mosaic membranes with optimum effectiveness in piezodialysis can be derived from theoretical considerations, actual mosaic membrane synthesis on this program met with considerable difficulty. (Horowitz-Office of Saline Water)
W71-13995

IN-SITU FORMATION OF REGENERATIVE CELLULOSE ACETATE MEMBRANES ON POROUS TUBULAR SUPPORTS,
McDonnell Douglas Astronautics Co., Newport Beach, Calif.
H. K. Bishop, G. Belfort, and G. A. Guter.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Office of Saline Water Research and Development Progress Report No. 464, Oct 1969. 67 p, 17 fig, 24 tab, 5 ref. OSW Contract 14-01-0001-1760.

Descriptors: *Reverse osmosis, *Membranes, *Membrane processes, *Semipermeable membranes, *Permselective membranes, Pressure, Desalination, Separation techniques, Saline water, Desalination processes, Osmosis.
Identifiers: *In-situ membrane regeneration, *Cellulose acetate membranes, Porous tubular supports, Shell and tube configuration.

This study has demonstrated the feasibility of in-situ cast regenerable cellulose acetate membranes. It has allowed the development of techniques for the forming of reverse osmosis membranes directly onto the porous support. This technique enables the membrane to be removed and reformed without disassembling the pressure vessel. Membrane formation may be accomplished by filling the container enclosing the porous tubular supports with the casting solution, allowing the container and tubes to drain, gelling the residual film with cold water and curing with hot water. The simplicity of this technique should be applicable to large reverse osmosis plants. Both high salt rejecting membranes (99.6% at 2 GFD) and high flux membranes (155 GFD with a salt rejection of 27%) have been prepared. Membranes with 98% salt rejection had a flux of 8-11 GFD. Since product water flux can greatly influence operating costs, methods for improving flux merit further study. In-situ cast membranes appear quite stable showing little or no performance decline even after 2000 hours on test at 600 psi. Membranes were regenerated six times with no decline flux. Salt rejection initially declined 10% and remained approximately constant throughout the remaining regenerations. The continued high water flux during the regeneration test is very encouraging indicating that the pores of the support are remaining open. (Kindley-Office of Saline Water)
W71-13997

CHARACTERIZATION OF CELLULOSE ACETATE MEMBRANES AND ULTRATHIN FILMS FOR REVERSE OSMOSIS,
General Electric Co., Schenectady, N.Y.
C. P. Bean.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price $0.70. Office of Saline Water Research and Development Progress Report No. 465, Oct 1969. 73 p, 28 fig, 4 tab, 40 ref. OSW Contract 14-01-0001-1480.

Descriptors: *Reverse osmosis, *Membranes, *Electrical impedance, *Diffusion, Pressure, Permselective membranes, Semipermeable membrane, Osmosis.
Identifiers: *Ultrathin membranes, *Electrical capacitance, *Salt rejection, Water flux, Salt rejecting layer, Porous membrane.

The principal conclusions of the studies reported are: (1) it is possible to measure electrical impedance of cellulose acetate membranes in contact with salt solutions and deduce several aspects of the physical structure of the salt rejection layer, (2) measurements of the electrical capacitance allow inference of the thickness of this layer, (3) this thickness (assuming the conventional dielectric constant) appears uniformly thinner than the geometrical thickness of the dense layer, (4) the salt rejecting layer of modified membranes both becomes more rejecting and thicker on heat treatment while the effective thickness of ultrathin membranes is unaffected by heat treatment, (5) diffusion and pressure induced flow of water through fine pores in the range of radii from 150 A to 1,500 A show agreement with conventional theoretical predictions. This result indicates that there are no significant anomalies in the structure of dynamics of water near hydrophilic surfaces, (6) theoretical studies on the possibilities of salt rejection by neutral pores show that the rejection is much greater than previously hypothesized and leads to the conclusion that specified fine pore structures will have high (S99%) rejection with flows that are predicted to be orders of magnitude greater than those currently attained. (Kindley-Office of Saline Water)
W71-13998

INVESTIGATION OF A PROCESS FOR REMOVAL OF COPPER FROM SEA WATER DESALINATION PLANT EFFLUENT USING CARBON SORBATES,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
R. H. Moore.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price $1.00. Office of Saline Water Research and Development Progress Report No. 651, May 1971. 87 p, 27 fig, 7 ref, 2 append. OSW Contract 14-30-2668.

Descriptors: *Desalination, *Sorption, *Ion exchange, Chelation, Beds, *Copper, Ions, Copper alloys.
Identifiers: *Corrosion product removal, *Active carbon, *Raffinate brine, Copper ions.

Carbon sorbates are products produced by sorption of chelating agents on active carbon. These products are ion exchangers in the hydrogen form which, through appropriate choice of chelating agent, react selectively with ions. Here copper ions, arising as a corrosion product from the use of cupro-nickel alloys must be removed from raffinate brines before these are released to the sea. Carbon sorbates have been found highly effective in this application. In 46 days continuous operation a 35.6 g. sorbate bed (9.09 w/o salicylaldoxime on Filtrasorb- 300 carbon) produced 4395 bed volumes of effluent no higher in Cu..2 content than natural sea water from brine (1.65 M NaCl) containing 1.0 mg/l Cu..2. Larger beds operating on brines high in Cu..2 (0.5 g/l Cu..2) have performed comparably. Elution with acid regenerates the beds. Eight chelating agents and six carbons have been evaluated. Most of the carbons and a number of reagents have been found suitable for use. Salicylaldoxime, 8-hydroxyquinoline, benzoylacetone, dibenzoylmethane, anthranilic acid, and mercaptobenzothiazole appear useful. Extraction capacity, relative rate of extraction, reagent wash-off rates, and performance in beds have been evaluated. (Filban-Office of Saline Water)
W71-13999

HIGH TEMPERATURE ELECTROCHEMICAL STUDY OF ALUMINUM ALLOYS FOR DESALINATION EQUIPMENT,
Reynolds Metals Co., Richmond, Va.
For primary bibliographic entry see Field 08G.
W71-14000

3B. Water Yield Improvement

ANTITRANSPIRATION EFFECTS ON THE TRANSPIRATION AND PHYSIOLOGY OF TAMARISK,
Arizona Univ., Tuscon. Dept. of Watershed Management.
Kenneth N. Brooks and David B. Thorud.
Water Resources Research, Vol 7, No 3, p 499-510, Jun 1971. 12 p, 3 fig, 10 tab, 21 ref. OWRR Project A-018-ARIZ (2).

Descriptors: *Transpiration control, *Evapotranspiration control, *Phreatophytes, *Water conservation, *Tamarisk, Water yield improvement, Water utilization, Photosynthesis.
Identifiers: *Antitranspirants, *Phreatophyte control.

Five-stamen tamarisk, an important phreatophyte in the southwestern United States, is difficult to eradicate for water salvage. There is also increasing opposition to its eradication because this species provides cover for wildlife and greenery in the environment. The application of nontoxic antitranspirant sprays to reduce tamarisk transpiration may be an alternative to eradication. Several antitranspirants were tested including a combination of the monomethyl and monoglyceryl esters of n-decenylsuccinic acid (MDSA-GDSA), 8-hydroxyquinoline sulfate (8-HQS), and phenylmercuric acetate (PMA), on tamarisk in greenhouse and field environments. PMA was toxic at a concentration of 0.001 M and was therefore not considered. Transpiration rates of plants treated with MDSA-GDSA and 8-HQS were 25-35% less than those of control plants for 20 days in the greenhouse and for at least 5 days in the field. Growth was reduced for 2-3 weeks, and net photosynthesis for less than 1 week. The other physiological factors were not changed substantially. Foliage temperatures increased 2 deg -3 deg C for 3 days following treatment in the field. (Knapp-USGS)
W71-13143

WEATHER MODIFICATION,
Resources Research Centre, Ottawa (Ontario).
A. K. Biswas.
Water Eng, Vol 75, No 901, p 108-114, Mar 1971. 7 p, 4 fig, 3 tab.

Descriptors: *Weather modification, Cloud seeding, Nucleation, Silver iodide, Precipitation (Atmospheric), *Induced precipitation, Economics, Cloud physics, Mathematical models, Social aspects, Legal aspects, Dry ice, Technology, Watershed management, Natural resources, Ice crystals, Foreign research.
Identifiers: Supercooled clouds, Hail control, Canada.

Man has attempted to modify weather from time immemorial. It was noted as early as the 1st century AD, and confirmed again during Civil War days, that rain followed soon after a big battle. The science of weather modification has advanced greatly from these early days, but still has far to go. Researchers concerned with formation of clouds and precipitation mechanisms generally accept that

2 main processes cause clouds to release precipitation: (1) the Bergeron-Findeisen or ice-crystal process, and (2) the accretion process. Man has been protected by modifying the microclimate through cooling, heating, and ventilating buildings. Cities change the movement, temperature, and cleanliness of air masses overhead. On a larger scale, scientists are working on controlled weather modification by including rainfall over a watershed, suppressing hail storms, and affecting the development of storm systems. Some significant advantages of weather modification are reviewed.
W71-13165

RECENT DECLINE IN THE DISTRIBUTION AND ABUNDANCE OF EURASIAN MILFOIL IN CHESAPEAKE BAY,
Johns Hopkins Univ., Baltimore, Md. Dept. of Pathobiology.
S. Bayley, H. Rabin, and H. Southwick.
Chesapeake Science, Vol 9, No 3, p 173-181, 1968. 5 fig, 3 tab, 6 ref.

Descriptors: *Aquatic weeds, *Plant diseases, *Plant pathology, Bacteria, Distribution, Viruses, Toxins, Genetics, Submerged plants, Sago pondweed, Widgeon grass, Maryland, Virginia.
Identifiers: *Eurasian milfoil, *Chesapeake Bay (Md-Va), *Myriophyllum spicatum, Elodea canadensis, Northeast disease, Lake Venice disease.

Eurasian water milfoil, a weed in Chesapeake Bay expanded to nuisance proportions preceding 1965. In late 1964 and 1965, pathologic states covered most milfoil beds. Study of milfoil ecology and diseases involved distributional surveys of abundance, studies on water quality conditions perhaps relating to growth, and investigation of milfoil diseases. Responsibility for the significant decline in abundance was laid to several pathologic conditions, previously named Northeast disease and Lake Venice disease. Evidence that Northeast condition is an infectious disease is presented. Its symptoms can be transmitted in laboratory by a bacteriologically sterile filtrate passed through a 0.2 micron filter, indicating a virus, virus-like particle, or a toxin as the etiologic agent; the primary pathogen is probably a virus. Gram-negative bacilli obtained from diseased milfoil probably represent secondary infections. Resurgence of growth and successful flowering in several areas, in September 1967, may represent development of genetic resistance to the pathogen, or it may be a natural cyclic pattern with reduced pathogen virulence. In November 1967, milfoil in Middle River collapsed more than expected from normal winter kill and that remaining was in poor condition. (Jones-Wisconsin)
W71-13179

WATER--THE DEPARTMENT OF THE INTERIOR'S SYSTEMATIC MANAGEMENT OF A RESOURCE,
Department of the Interior, Washington, D.C. Water Quality and Research.
For primary bibliographic entry see Field 03A.
W71-13189

CONJUNCTIVE USE OF SEA AND FRESH WATER RESOURCES: AN INTEGER PROGRAMMING APPROACH,
California Univ., Los Angeles. Dept. of Systems.
For primary bibliographic entry see Field 06A.
W71-13220

HYDROLOGIC RESPONSE OF A YOUNG PINE PLANTATION TO WEED REMOVAL,
Georgia Univ., Athens. School of Forest Resources.
J. L. Lambert, W. R. Gardner, and J. R. Boyle.
Water Resources Research, Vol 7, No 4, p 1013-1019, August 1971. 5 fig. 10 ref.

Descriptors: *Evapotranspiration, *Weed control, *Water yield improvement, Infiltration, Water utilization, Consumptive use, Watershed management, Infiltration, Herbicides, Wisconsin.
Identifiers: Weed removal.

In May 1969 the weed vegetation on one plot in a 7-year-old red pine plantation was killed by using herbicides. The site was a glacial outwash plain in Adams County, Wisconsin. Of the 27 cm of precipitation that occurred in June, July, and August of that year, evapotranspiration accounted for 16 cm on a plot with weeds and only 9 cm on the plot without weeds. But nearly all of this excess was lost from the root zone by a 61% increase in drainage associated with weed removal, so the increase of water available to plants was not great. The increase was most obvious in the surface layer beneath the trees where it amounted to 28%. In the openings between trees, the surface layer was actually drier owing to greater surface heating caused by removal of weeds. Important factors that amplified the effects of treatment were the erratic precipitation regime and the sandy texture of the soil. (Knaap-USGS)
W71-13286

CARBONATE EQUILIBRIA DISTRIBUTION AND ITS RELATION TO AN AREA OF HIGH GROUND-WATER YIELD IN NORTHWEST OHIO,
Geological Survey, Columbus, Ohio.
For primary bibliographic entry see Field 02K.
W71-13462

SOUTH AFRICA'S WATER BUDGET,
Department of Water Affairs, Pretoria (South Africa). Div. of Hydrology.
J. S. Whitmore.
South African Journal of Science, Vol 67, No 3, p 166-176, March 1971. 2 fig, 3 tab.

Descriptors: *Hydrologic cycle, *Hydrologic budget, *Water conservation, *Planning, *Water harvesting, Evaporation, Transpiration, Cloud seeding, Interception, Economic feasibility, Groundwater recharge, Soil moisture, Water policy.
Identifiers: *South Africa.

The effects of rising population, rising living standards and urbanization will probably treble total annual South African water requirement to about 29 million cubic meters by the year 2000. Present knowledge and methods indicate that only about 21 million cubic meters will be available. The water budget of the country is reviewed and fairly accurate estimaes are presented for the quantities of water involved at each step of the hydrological cycle. With this data it is possible to assess various strategies aimed at increasing the amounts of available water at different points in the cycle. A basic premise is that those phases of the cycle involving the most water offer the greatest scope for intervention and accordingly the greatest potential benefit. The possible approaches discussed include rainfall stimulation, reduction of interception, evaporation and transpiration losses, groundwater recharge, water reuse, recovery of soil moisture and extraction of water from atmospheric vapor at ground level. (Casey-Arizona)
W71-13573

THE INFLUENCE OF VEGETATION IN SOUTH AFRICAN MOUNTAIN CATCHMENTS ON WATER SUPPLIES,
Stellenbosch Univ. (South Africa); and Department of Forestry, Stellenbosch (South Africa).
C. L. Wicht.
South African Journal of Science, Vol 67, No 3, p 201-209, March 1971. 2 tab, 31 ref.

Descriptors: *Vegetation effects, *Watersheds, *Evaporation, *Runoff, *Transpiration, Ecosystems, Biological communities, Ecology, Plant populations, Succession, Hydrologic cycle, Soil water movement, Soil-water-plant relationships.
Identifiers: *South Africa, *Water potential, *Potential evapotranspiration.

The hydrologic cycle is briefly reviewed and the simplest form of the hydrologic equation is given for a long term period of a mountain watershed with climax vegetation: precipitation equals vapor loss plus stream-discharge. Vegetation influences the precipitation within the catchment, the volume and duration of water storage, the volume of water vaporized, and thus, the remainder yielded to the stream. Although soil, climate and vegetation factors interact, the major vegetation influence on the hydrology of the watershed is the promotion of vaporization. Data from various world vegetation regions is summarized and indicates immense changes in runoff as a result of small changes in vaporization. The character of the vegetation also influences water storage and indirectly, runoff. As plant succession proceeds, vaporization increases. Dense vegetation will promote vaporization, retard discharge and amelio-rate runoff, while light vegetation has the opposite effects. In regions where the volume of mountain catchment runoff is critical, the problem is to alter the vegetation of the catchment so as to increase runoff without permanently damaging the catchment. Available data are summarized on the hydrological effects of vegetation in South African mountain catchments and they support the view, that with careful management, stream flows may be significantly increased in this water-short country. (Casey-Arizona)
W71-13575

PATTERNS OF DISTRIBUTION OF SOME XEROPHYTIC SPECIES IN THE NEGEV, ISRAEL,
Tel-Aviv Univ. (Israel). Dept. of Botany.
For primary bibliographic entry see Field 02I.
W71-13576

PROSPECTS FOR COTTONWOOD UTILIZATION IN ARIZONA,
Rocky Mountain Forest and Range Experiment Station, Flagstaff, Ariz.; and Arizona Univ., Tucson. Dept. of Watershed Management.
For primary bibliographic entry see Field 04A.
W71-13600

EFFECTS OF STIMULATION ON WELL OPERATING COSTS AND ITS PERFORMANCE ON OLD AND NEW WELLS,
Koenig (Louis) Research, Inc., San Antonio, Tex.
For primary bibliographic entry see Field 04B.
W71-13710

OCCURRENCE OF GROUNDWATER IN KIMBALL COUNTY, NEBRASKA INCLUDING LOGS OF TEST HOLES,
Nebraska Univ., Lincoln, Conservation and Survey Div.
For primary bibliographic entry see Field 04B.
W71-13845

PRECIPITATION MODIFICATION,
National Water Commission, Arlington, Va.
Jack D. Lackner.
Available from National Technical Information Service as PB-201 534, $3.00 per copy; $0.95 microfiche. Report NWC-EES-71-005, July 1971. 170 p, 8 tab, 91 ref.

Descriptors: *Weather modification, *Cloud seeding, *On-site tests, *Evaluations, *Water supply, *Water yield improvement, Artificial precipitation, Clouds, Rain, Statistical methods, Reviews, Water utilization, Rainfall-runoff relationships, Streamflow, Reservoir yield, Environmental effects, Economic feasibility, Legal aspects, Water resources development, Water management (Applied), *Reviews.

Identifiers: *Precipitation—modification, *Water supply augmentation, Hydrologic models, Alternative futures, Water policy, Recommendations, Institutional aspects.

An evaluation is made of the effectiveness of cloud seeding in increasing precipitation from orographic, convective, and cyclonic storm systems. The evaluation is based on published conclusions of various panels of atmospheric scientists and on the reported results of well designed field tests. Primary interest centers on the leverage increased precipitation may exert in augmenting water supply. Information on the potential impact of increased precipitation on usable water supply, based upon the use of hydrologic models and reservoir storage-yield relationships, is summarized. The nature of potential downwind precipitation effects and environmental side-effects are identified along with the nature of inadvertent modification. A discussion is given of the potential economic feasibility of cloud seeding projects and of the difficulty of assessing the total social benefits and costs of weather modification. The status of the legal and institutional aspects of precipitation modification is given. Recommendations regarding the potential impact of precipitation modification in augmenting water supplies are made to the National Water Commission for consideration in making its projections of future water needs and spplies.
W71-13873

3C. Use of Water of Impaired Quality

WATER--THE DEPARTMENT OF THE INTERIOR'S SYSTEMATIC MANAGEMENT OF A RESOURCE,
Department of the Interior, Washington, D.C. Water Quality and Research.
For primary bibliographic entry see Field 03A.
W71-13189

THE IMPACT OF THE WATER '70 CAMPAIGN,
University of the Witwatersrand Univ., Johannesburg (South Africa). Dept. of Hydraulic Engineering.
For primary bibliographic entry see Field 06B.
W71-13572

A COMPARISON OF DEEP AND SHALLOW DRAIN TILE FOR REDUCTION OF SOIL SALINITY IN IMPERIAL VALLEY.
California Univ., Davis. Dept of Water Science.
F. E. Robinson and J. N. Luthin.
California Agriculture, Vol 21, No 2, February 1967, p 2-4. 1 fig, 4 tab.

Descriptors: *Saline soils, *Irrigation effects, *Saline water, *Soil management, *Irrigation design, Soil conservation, Irrigation water, Farm management, Flood irrigation, California, Arid lands, Crops, Salts, Leaching.
Identifiers: *Salt accumulation.

Excess salt accumulation resulting from high saline water tables or concentration of salts from irrigation water can render farmland useless for growing crops. In one experiment, constant flooding removed more salt per time-unit than intermittent flooding, but intermittent flooding removed more salt per volume of water used. In another experiment, shallow drain tiles were installed in plots, and these increased the rate of salt removal at shallow and deep depths with intermittent flooding, and at all but deep depths with constant flooding. The plots were located on heavy clay soil. (Yensen-Arizona)
W71-13592

NEW AND USED WATER FOR INDUSTRIAL NEEDS - WHERE AND WHEN,
Ford Motor Co., Detroit, Mich. Facility Environment Control Section.
S. H. Vaughn.
In: Proceedings of the 13th Conference of Great Lakes Research, 1970. International Association of Great Lakes Research, p 567-570.

Descriptors: *Water reuse, *Industrial water, *Impaired water quality, Waste water treatment, Water pollution sources, Economic feasibility, Water quality control, Chemicals.
Identifiers: Processing requirements.

Industry will be recycling much of its process water as the costs of purchasing new water and treatment of wastewater discharged into the sewer increase. The decision to recycle process water depends principally upon the quality of water required for the process and how seriously the water is affected by the process. There are three general classifications of process water: (1) High quality water which is not seriously affected by the process, (2) low quality water which is seriously affected by the process, and (3) high quality water which is seriously affected by the process. In the first case, costs of recycling derive mainly from the need to allow some blowoff to control dissolved solids and the need to remove dissolved chemicals used in the recycling process before releasing water to the sewer. In the second case, recycling is generally favored because expensive chemicals are used in the process itself. It is not favored in the third case because raising used water to the very high standards required is very expensive. In all cases the decision on what water can be recycled is not casual but based on careful evaluations of processing requirements. (Dyer-Wisconsin)
W71-13652

3D. Conservation in Domestic and Municipal Use

PUBLIC AND INDUSTRIAL WATER SUPPLIES OF KENTUCKY, 1968-69,
Geological survey, Louisville, Ky.
For primary bibliographic entry see Field 06D.
W71-13829

WASTEWATER REUSE,
National Water Commission, Arlington, Va.
For primary bibliographic entry see Field 05D.
W71-13871

SYSTEMS ENGINEERING FOR URBAN UTILITIES,
Parsons, Brinckerhoff, Quade, and Douglas, New York. Advanced Technology Div.
For primary bibliographic entry see Field 06A.
W71-13975

3E. Conservation in Industry

WASTES FROM BRITISH PAPER MILLS,
Wiggins Teape Research and Development Ltd., Beaconsfield (England).
For primary bibliographic entry see Field 05D.
W71-13420

UTILIZATION OF PHOSPHATE SLIMES,
International Minerals and Chemical Corp., Skokie, Ill.
For primary bibliographic entry see Field 05D.
W71-13517

NEW AND USED WATER FOR INDUSTRIAL NEEDS - WHERE AND WHEN,
Ford Motor Co., Detroit, Mich. Facility Environment Control Section.
For primary bibliographic entry see Field 03C.
W71-13652

THE OIL AND GAS INDUSTRY AND WATER CONSERVATION,
For primary bibliographic entry see Field 05G.
W71-13686

PUBLIC AND INDUSTRIAL WATER SUPPLIES OF KENTUCKY, 1968-69,
Geological survey, Louisville, Ky.
For primary bibliographic entry see Field 06D.
W71-13829

WASTEWATER REUSE,
National Water Commission, Arlington, Va.
For primary bibliographic entry see Field 05D.
W71-13871

3F. Conservation in Agriculture

WATER--THE DEPARTMENT OF THE INTERIOR'S SYSTEMATIC MANAGEMENT OF A RESOURCE,
Department of the Interior, Washington, D.C. Water Quality and Research.
For primary bibliographic entry see Field 03A.
W71-13189

OPTIMAL INTRASEASONAL IRRIGATION WATER ALLOCATION,
Montana State Univ., Bozeman. Dept. of Economics and Agricultural Economics.
For primary bibliographic entry see Field 06A.
W71-13226

STUDY OF THE PARAMETERS OF RADIOCOBALT TRANSFER IN CONTINENTAL AQUATIC AND IRRIGATED ECOSYSTEMS,
Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
For primary bibliographic entry see Field 05C.
W71-13381

ANNUAL REPORT, 1970-1971.
Arizona Univ., Tucson. Environmental Research Lab; and Arid Lands Research Center, Abu Dhabi (Trucial Oman).
For primary bibliographic entry see Field 02I.
W71-13569

REGIONAL WATER RESOURCES PLANNING IN SOUTH AFRICA,
For primary bibliographic entry see Field 06B.
W71-13579

CONSERVATION TECHNOLOGY AND CAPITAL FORMATION IN ARID AGRICULTURE,
Agro-Economic Research Centre, Vallabh Vidyanagar (India).
N. S. Jodha.
Annals of Arid Zone, Vol 9, No 4, p 215-220, December 1970. 2 tab, 7 ref.

Descriptors: *Arid lands, *Water conservation, *Capital, *Economic efficiency, *Agriculture, Expenditures, Economic feasibility, Dry farming.
Identifiers: *India.

The 2 principal problems of agriculture in the arid zone of northwestern Rajasthan are low and unstable crop (and livestock) production and rapid natural resource depletion due to unscientific farming practices. The problem of production variability is directly related to water scarcity. Many water conservation methods may be introduced into dry-land agriculture such as shelterbelts or windbreaks, bunding (and other earthworks) micro-windbreaks, sand dune stabilization and range reseeding. Conservation methods will not only stabilize water supplies but also counteract resource depletion processes and even raise the productivity of arid lands. These improvements may therefore increase farm capital; and the extent to which conservation technology is practiced in a region may be

an indicator of the rate of capital formation. Analyses of both public and private expenditures in India for these improvements indicate that virtually nothing is spent in either sector. This may have several undesirable ramifications: (1) any attempt to increase capital formation by maintaining the present structure of Indian agriculture will only lead to furthur intensification and accelerate resource depletion; (2) the present structure of farm capital, devoid of conservation methods, results in inefficient utilization of water and any increase in water supplies will only result in greater use inefficiencies; (3) any attempt, therefore, to increase capital without increasing usable moisture would only result in greater underutilization of farm assets. (Casey-Arizona)
W71-13580

WATER STRESS DURING FLOWERING OF COTTON,
California Univ., Davis. Dept. of Water Science.
D. W. Grimes, R. J. Miller, and L. Dickens.
California Agriculture, Vol 24, No 3, March 1970, p 4-6. 3 fig.

Descriptors: *Moisture stress, *Cotton, *Drying, *Crop production, *Crop response, Water requirements, Crops, Productivity.

It has been shown that a period of mild water stress before flowering results in higher cotton production. In these experiments, a nine-day period of severe water stress during the peak flowering period caused a more greatly reduced yield than earlier or later periods of water stress. The periods of water stress were long enough to produce pronounced leaf wilting nd some leaf drop. Neither boll size nor lint percentage was significantly affected by the water-stress treatments. (Yensen-Arizona)
W71-13587

INSECTS IN COTTON AS AFFECTED BY IRRIGATION AND FERTILIZATION PRACTICES,
California Univ., Davis. Dept. of Water Science; and Department of Agriculture, Shafter, Calif. Cotton Research Station.
T. F. Leigh, D. W. Grimes, H. Yamada, D. Basset, and J. R. Stockton.
California Agriculture, Vol 24, No 3, p 12-14, March 1970. 4 fig, 3 tab.

Descriptors: *Irrigation effects, *Insect control, *Nitrogen, *Irrigation, *Farm management, Cotton, Irrigation design, Cultural control, Insects, Irrigation efficiency, Fertilizers, Pest control, Crop response.
Identifiers: *True Bugs, *Mites.

In this experimental program, cotton plots with the highest irrigation frequency and the highest nitrogen level had strikingly increased levels of lygus bags. Plots with lesser, and least amounts of irrigation and nitrogen had many fewer and the least amount of lygus, respectively. The big-eyed bug was most numerous in the plots with infrequent irrigation and least abundant in the wetter plots which also had the highest lygus counts. Spider mites were found most abundantly in plots with heavy irrigation and moderate amounts of added nitrogen. Cotton lint yield gains resulting from the addition of nitrogen occurred only at the lowest irrigation level. Increased irrigation improved yield, but the very wet treatment reduced yield at all levels of nitrogen. (Yensen-Arizona)
W71-13588

A COMPARISON OF DEEP AND SHALLOW DRAIN TILE FOR REDUCTION OF SOIL SALINITY IN IMPERIAL VALLEY.
California Univ., Davis. Dept of Water Science.
For primary bibliographic entry see Field 03C.
W71-13592

EFFECTS OF MOISTURE STRESS ON THE MULTIPLICATION AND EXPANSION OF CELLS IN LEAVES OF SUGAR BEET,
California Univ., Berkeley. Dept. of Soils and Plant Nutrition.
For primary bibliographic entry see Field 02I.
W71-13602

AN EVALUATION OF SPRINKLER IRRIGATION FOR IMPERIAL VALLEY,
California Univ., El Centro. Imperial Valley Field Station.
F. E. Robinson, O. D. McCoy, and G. F. Worker, Jr.
California Agriculture, Vol 21, No 2, February 1967. p 6-8.

Descriptors: *Sprinkler irrigation, *Irrigation ditches, *Irrigation efficiency, *Irrigation operation and maintenance, *Crop response, Crop production, Crops, Furrow irrigation.

In experiments using beds of carrots, onions, lettuce, cabbage, and sugar beets, row irrigation was found to be significantly more time-consuming and to use considerably more water than sprinkler irrigation. Sprinkling produced a greater percent of seed germination and a higher yield, while allowing greater flexibility in bed size and smape. Cooling of the soil and removal of surface salt were other advantages of sprinkling, and it was found that less seed was required to be sown. (Yensen-Arizona)
W71-13603

WHO GETS THE WATER,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
C. B. Lewis, and A. W. Epp.
Farm Ranch and Home Quarterly, Summer, 1971. 3 p.

Descriptors: *Nebraska, *Water allocation (Policy), *Irrigation efficiency, *Direct benefits, *Alfalfa, *Corn, *Soybeans, *Crop response, Streamflow, Decision making, Variable costs, Fixed costs.
Identifiers: *Lower Platte Valley.

Since the supply of surface water not allocated to a specific use is limited and, according to Nebraska law, allocation of water rights is permanent, alternative approaches to future allocation must be analyzed. The Linwood Unit of the Lower Platte Valley was studied. Three approaches were compared over a 35-year period: (1) diversion of needed water from direct stream flow for 10,500 acres with few seasonal shortages, (2) diversion of direct stream flow for 21,000 acres with more seasonal shortages, and (3) allocation of direct stream flow to 31,500 acres with frequent periods of less than optimum water available. The only variation in the production cost was the amount of crop harvested: the amount decreased with increases in the number of acres irrigated. The returns over variable costs minus fixed costs showed direct benefits for the area. Net benefits from the 21,000 acre project were the highest. They were also the highest when benefits were measured by considering the net returns to the land. Gross returns, however, were higher for the 31,500 acre project indicating that benefits to the larger area might be considerably higher than those to the smaller (economic multiplier effects).
W71-13651

USING SOIL FILTRATION TO REDUCE POLLUTION POTENTIAL OF LAGOON EFFLUENT ENTERING GROUND WATER SYSTEM,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 05D.
W71-13656

FLOOD PROTECTION ON CAYUGA ISLAND AT AND IN THE VICINITY OF LITTLE RIVER AND CAYUGA CREEK, NIAGARA COUNTY, NEW YORK.
Army Engineer District, Buffalo, N.Y.
For primary bibliographic entry see Field 04A.
W71-13876

UTILIZATION OF WATER IN A SEMI-ARID REGION,
New Mexico Univ., University Park. Plains Branch Experiment Station.
Dale H. Fuehring.
Available from the National Technical Information Service as PB-203 491. $3.00 in paper copy, $0.95 in microfiche. New Mexico Water Resources Research Institute, La Cruces, Completion Report, June 1971, 3 p. OWRR A-027-NMEX (1).

Descriptors: *Arid lands, *Moisture availability, Herbicides, Crops, Rainfall, Agricultural watersheds.
Identifiers: Propazine, Atrazine.

In order to assess the value for dryland cropping in a semi-arid region of concentrating rainfall by means of micro-watersheds, a study was established with width of micro-watershed, width of growing bed, plant population, and applied level of nitrogen fertilizer as variables. Due to very low rainfall, little water was available for concentration and yields of winter wheat and winter barley were very low and were decreased with increasing amount of watershed area (proportionately less of area planted). A study on use of herbicides indicates propazine and atrazine applied on the watershed areas may control weeds without injury to crops. It was concluded that the first year results of the study were atypical because of extreme drought and that several years data will be necessary in order to sample various amounts and patterns of annual rainfall and to determine the cumulative effects.
W71-13901

MOVEMENT AND PASTORAL NOMADISM: A TENTATIVE MODEL,
Air Force Academy, Colorado Springs, Colo. Dept. of Geography.
For primary bibliographic entry see Field 06G.
W71-13904

EFFECT OF ROW GRADES AND TILLAGE SYSTEMS ON SOIL AND WATER LOSSES,
Agricultural Research Service, Ames, Iowa. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02J.
W71-13911

EFFECTS OF GROUND-WATER DEVELOPMENT ON THE WATER REGIME OF PARADISE VALLEY, HUMBOLDT COUNTY, NEVADA, 1948-68, AND HYDROLOGIC RECONNAISSANCE OF THE TRIBUTARY AREAS,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 04B.
W71-13934

WATER RESOURCES PLANNING MODEL, (A Technical Note),
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Building Research.
For primary bibliographic entry see Field 06A.
W71-13977

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

THE FORMATION OF PLANT AGGREGATIONS ON THE ASH TIP OF THE SOUTH KUZ-

BASSK STATE REGIONAL ELECTRIC POWER PLANT IN DIFFERENT EXPERIMENTAL VARIANTS,
For primary bibliographic entry see Field 02I.
W71-13136

THE VEGETATION OF THE ONON RIVER VALLEY (IN THE SOUTHEASTERN TRANSBAIKAL),
A. M. Zarubin.
Izv Biol-Geogr Nauch-Issled Inst Irkutsk Univ. 23 (3): 97-103. 1969. (Translated from Ref Zh Biol, 1970, No. 7V583.).
Identifiers: Apple-D, Bird, Cherry-D, Grasses-M, Hawthorn-D, Onon, River, Sedges-M, Transbaikal, USSR, Valley, Vegetation, Willow-D.

The Onon River starts in the Mongolian People's Republic in the Khentei Range. The floodplain width averages 3.5-5km. The islands and the floodplain near the river channel are associated with shrubby thickets of different species of willow, European birdcherry, hawthorn, and apple; the open areas have associations of reedgrass, wildrye, and bentgrass. The ridges have growths of Poa botryoides and Koeleria; in shallow sinkholes there are clumps of foxtail and sweetgrass; in shallow gullies there are different species of sedge. The central part of the floodplain is mostly plowed up, but on virgin areas there are wildrye and Agrostis trinii. Outside of populated places, hard sedge steppe associations of mixed herbage turning to steppe predominate. Bogs near the terraces have aggregations of Carex schmidtii. Also found are halophytic variants of true and bog meadows (barley, alkaligrass, and others).--Copyright 1971, Biological Abstracts, Inc.
W71-13137

THE ROLES OF SPARTINA SPECIES IN NEW ZEALAND,
Department of Agriculture, Mosgiel (New Zealand). Invermay Agricultural Research Center.
L. D. Bascand.
N Z Ecol Soc Proc. 17. 33-40. Illus. 1970.
Identifiers: Fore, New-Zealand, Productivity, Protection, Shore, Spartina-Alterniflora-M, Spartina-M, Spartina-Townsendii-M, Species.

The distribution and rates of spread of different growth forms of S. townsendii and of S. alterniflora in New Zealand are discussed and rates of sedimentation measured in Spartina plantations in Northland are compared with those recorded in Southland and in England. Gross productivities of plantations in Northland are compared with English and American data and problems associated with foreshore protection are considered. Spartina is undoubtedly a valuable plant aid to land reclamation, but its introduction to new areas should take into account both alternative uses of aquatic environments and problems arising from its uncontrolled spread.--Copyright 1971, Biological Abstracts, Inc.
W71-13139

THE APPLICATION OF THE DSDT HYBRID COMPUTER METHOD TO WATER RESOURCES PROBLEMS,
California Univ., Los Angeles. School of Engineering and Applied Science.
For primary bibliographic entry see Field 06A.
W71-13151

USE OF WATER TEMPERATURE STUDY TO DEFINE SEEPAGE PATHS,
Corps of Engineers, Baltimore, Md.
For primary bibliographic entry see Field 08D.
W71-13156

USE OF MONTE CARLO TECHNIQUES IN THE DESIGN AND OPERATION OF A MULTIPURPOSE RESERVOIR SYSTEM,
California Univ., Los Angeles. School of Engineering and Applied Science.
For primary bibliographic entry see Field 06A.
W71-13224

A RIVER AS A CHEMICAL REACTOR,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13272

AN EVOLUTIONARY RIVER MODEL VIA ON-LINE SYSTEM IDENTIFICATION,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13277

AN EVOLUTIONARY RIVER MODEL VIA CONTINUOUS ON-LINE SYSTEM IDENTIFICATION,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13278

A STUDY OF A WATER POLLUTION CONTROL SYSTEM TO MAINTAIN THE DISSOLVED OXYGEN STANDARD,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13279

DEVELOPMENT OF A WATER QUALITY CONTROL STRATEGY FOR RIVERS AND ESTUARIES USING HYBRID COMPUTER MODELING TECHNIQUES,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13280

PREDICTION ERROR OF REGRESSION ESTIMATES OF STREAMFLOW CHARACTERISTICS AT UNGAGED SITES,
Geological Survey, Arlington, Va.
For primary bibliographic entry see Field 02E.
W71-13454

CARRYOVER STORAGE REQUIREMENTS FOR RESERVOIR DESIGN IN MISSOURI.
Geological Survey, Rolla, Mo., Water Resources Div.
For primary bibliographic entry see Field 08A.
W71-13505

FLOOD PLAIN INFORMATION, TINKER AND CARVIN CREEKS, ROANOKE, VIRGINIA.
Corps of Engineers, Wilmington, N.C.

Army Corps of Engineers Flood Plain Report, October 1970. 42 p, 13 fig, 29 plate, 14 tab.

Descriptors: *Floods, *Flood damage, *Flood plains, *Virginia, Long-term planning, Historic flood, Overflow, Design flood, Regional flood, Land use, Project planning, Flood forecasting, Flood protection.
Identifiers: Tinker Creek (Va), Carvin Creek (Va), Intermediate regional flood, Standard project flood.

A summary of the flood situation at Roanoke, Virginia is given to aid in planning for the solution of local flood problems and in the best utilization of land subject to overflow. The report covers two phases; first, it presents a record of the largest known floods on Tinker and Carvin Creeks, and second, it describes the effects of probable future Intermediate Regional Floods and Standard Project Floods. Maps, Profiles, and cross sections illustrate depths of probable flooding, either by recurrence of the largest known floods or by occurrence of the Intermediate Regional or Standard Project Flood at specific locations. Such data allows for design of building floor levels to avoid flood damage or with recognition of hazard's being taken. The August 1940 flood is the greatest of record. Other floods occurred in August 1939, July 1947, August 1961, and July 1962. Water velocities during a major flood on the streams studied range up to 20 ft per sec in the channels; velocities on the flood plain vary widely but generally do not exceed 5 ft sec. Velocities that would occur in the intermediate regional and standard project Floods would be extremely dangerous to life and property. (Land-USGS)
W71-13510

PROSPECTS FOR COTTONWOOD UTILIZATION IN ARIZONA,
Rocky Mountain Forest and Range Experiment Station, Flagstaff, Ariz.; and Arizona Univ., Tucson. Dept. of Watershed Management.
R. L. Barger and P. L. Ffolliott.
Progressive Agriculture in Arizona, Vol 23, No 3, p 14-16, May-June, 1971. 1 fig, 12 ref.

Descriptors: *Cottonwoods, *Phreatophytes, *Arizona, Pulp and paper industry, Land management, Trees.

Cottonwood is found in narrow stringers along many of the drainages in Arizona, occasionally forming broad river-bottom groves. As part of ongoing water supply improvement measures, Cottonwoods and other phreatophytes have been removed or thinned in many areas. With minor exceptions, the timber cut has not been utilized. Cottonwood is a lower density native hardwood with many superior qualities. Potential commercial uses including crating, boxes and pallets, wood shavings for agricultural use, plywood veneer, chemical pulp and possibly as a livestock feed supplement. The most promising uses are in pulpwood and box and pallet manufacture. Cotgnwood can substitute for Aspen in pulping, and the industry is large enough to be relatively unaffected by fluctuations in supply. BECAUSE OF ITS INEVITABLY UNCERTAIN SUPPLY, ITS USE IN SAWMILLS SHOULD BE AUXILIARY TO MILL OPERATIONS BASED ON OTHER SPECIES. (Casey-Arizona)
W71-13600

A NOTE ON THE FIRST EMPTINESS TIME OF AN INFINITE RESERVOIR WITH INPUTS FORMING A MARKOV CHAIN,
Carnegie-Mellon Univ., Pittsburgh, Pa.
For primary bibliographic entry see Field 06A.
W71-13779

FLOOD FREQUENCY ESTIMATING TECHNIQUES FOR SMALL WATERSHEDS,
Hydrocomp International, Palo Alto, Calif.
For primary bibliographic entry see Field 06A.
W71-13781

HYDROLOGIC RELATIONSHIPS IN A CONIFEROUS FOREST,
Maine Univ., Orono. Forest Resources.
Charles E. Schomaker.
Completion Report, June 1971. 3 p, 1 ref. OWRR A-012-ME (2).

Descriptors: *Forest hydrology, Interception, Forest litter, Precipitation, Soil moisture depletion, Microclimate, Maine.

The purpose was to determine the total effect of a mixed coniferous forest stand on the distribution of the precipitation falling upon it. Such information would be useful in making sound forest land management decisions beneficial from a water resource and ecological point of view. Measurements of total precipitation (outside the stand), throughfall, stemflow, litter interception, soil moisture fluctuations, and groundwater changes were made during all or part of a two-year period ending June, 1971. Some microclimatic measurements were also collected. Results available estimate an average interception value by the forest canopy of 16 percent during the summer period.

Deducted from these losses would be stemflow which is estimated as 1 to 2 percent of the gross rainfall for the stand as a whole. Stemflow varied according to tree species being almost negligible for spruce and about 3 percent of the gross rainfall for white pine. Interception losses by the organic layer on the forest floor is often not considered by hydrologists but data collected here estimate losses of 16 percent, equal to or slightly greater than canopy interception losses.
W71-13803

FLOOD PLAIN INFORMATION, LITTLE KANAWHA RIVER, GRANTSVILLE, WEST VIRGINIA.
Corps of Engineers, Huntington, W Va.

Army Corps of Engineers Flood Plain Report, January 1970. 41 p, 9 fig, 10 plate, 8 tab.

Descriptors: *Floods, *Flood damage, *Flood plains, *West Virginia, Historic flood, Land use, Overflow, Design floods, Flood forecasting, Stream gages, Regional flood, River basin development.
Identifiers: Little Kanawha River (W Va), Intermediate regional flood, Standard project flood.

As an aid to solving flood problems and planning the best utilization of land subject to flooding, an analysis is made and a summary is given based on hydrologic information for the Little Kanawha River basin in the vicinity of Grantsville, West Virginia. All the business section and a large part of the residential section are situated near the confluence of Philip Run, Simon Run and the river, an area which is the hardest hit by flooding. A USGS stream gaging station maintained at Grantsville since October 1928 provides a 40-year record of river heights. The greatest flood of record occurred in the area in March 1967 and crested about a foot higher than the 1939 flood, the second highest of record. Other large floods occurred in 1918 and 1926. Flood season is late winter and early spring, but local storms commonly occur any time on the smaller streams with their steep grades and the rugged terrain that prevails. Duration of floods is relatively short. The 1967 flood had a maximum rate of rise of about 1.4 ft per hr and the river was out of banks for about 80 hr. (Lang-USGS)
W71-13830

DRAINAGE AREA OF LOUISIANA STREAMS,
Geological Survey, Baton Rouge, La. Water Resources Div.
For primary bibliographic entry see Field 07C.
W71-13848

PROBLEMS IN THE TRANSFORMATION OF RIVER SYSTEMS (Problemy preobrazovaniya rechnykh sistem),
S. L. Vendrov.
Gidrometeoizdat, Leningrad, 1970. 236 p.

Descriptors: *Water resources, *Water resources development, *River systems, *Water management (Applied), *River regulation, Water utilization, Routing, Reservoirs, Reservoir construction, Water quality, Water storage, Water supply, Water pollution, Waste water (Pollution), Waste water disposal, Streamflow, Estuaries, Lakes, Valleys, Bodies of water.
Identifiers: *USSR, Hydrographic network.

This two-part monograph is devoted to a general discussion of the water resources of the USSR and to an examination of recent transformations of a number of river systems in the country. The management of Soviet water resources is viewed as a vital national issue, stemming from (1) the uneven distribution of water in place and time; (2) the needs of a rapidly growing population for water supplies, waste disposal, and clean waters; (3) the increased industrial, domestic, and agricultural pollution of surface- and groundwaters; and (4) the often uncoordinated utilization of water resources by various branches of the national economy. The consequences of constructing new reservoirs and dams and of intensifying the degree of development of major channel and streamflow regulation are analyzed to determine their effect on the development of the hydrographic network and to find more suitable means of manipulating the natural water system. The solution to the problem of reconstructing the hydrographic network of the USSR on a regional and national basis calls for greater attention to applications of science and technology and for more intensive scientific research as a major instrument of water management. The text is designed for use by hydrologists, hydraulic engineers, climatologists, geographers, and other specialists engaged in a study of the rational and balanced use of water resources. (Josefson-USGS)
W71-13862

FORECASTING THE RUNOFF OF THE YENISEY RIVER AT KYZYL FOR A SPRING-SUMMER PERIOD (Prognoz stoka r. Yenisey u g. Kyzyl za vesenne-letniy period),
Moscow State Univ. (USSR). Chair of Hydrology.
V. N. Busarov.
Vestnik Moskovskogo Universiteta, Seriya 5, Geografiya, No 3, p 112-114, May-June 1971. 1 fig, 2 tab, 5 ref.

Descriptors: *Runoff, *Runoff forecasting, *Snowmelt, Seasonal, Precipitation (Atmospheric), Antecedent precipitation, Orography, Air temperature, Correlation analysis.
Identifiers: *USSR, Tuva ASSR, Yenisey River, Kyzyl, Correlation coefficient.

The preparation of a reliable long range forecast of spring-summer runoff on rivers in mountain basins is complicated by the absence of a dense network of meteorological stations and by the difficulty of calculating snow storage in upper parts of the basin by measurement of temperature gradients and precipitation. To develop techniques for forecasting the unregulated runoff of the Upper Yenisey River near Kyzyl (Tuva ASSR) for the period April-August, a snow-storage index was calculated, based on the correlation between the volume of runoff for the period and the modular coefficient of winter precipitation for four meteorological stations for the antecedent period October-April. A second variable--winter air temperature--was used to compensate for the inaccurate determination of snow storage based on precipitation data. An inverse relationship was established between the winter temperatures and the spring-summer runoff. The coefficient of correlation was 0.77. A forecast of April runoff may be prepared on April 1 on the basis of the predicted precipitation. The procedure examined may be used for predictions up to 6 months. (Josefson-USGS)
W71-13869

SPRING CREEK CHANNEL IMPROVEMENT (LOCAL FLOOD PROTECTION PROJECT), SPRINGDALE, ARKANSAS.
Corps of Engineers, Tulsa, Okla. Tulsa District.

Available from the National Technical Information Service as PB-198 744-D, $3.00 in paper copy, $0.95 in microfiche. Draft environmental statement, 10 March 1971. 9 p.

Descriptors: *Channel improvement, *Environmental impact, *Flood control relocation.
Identifiers: *Environmental surveys, *Arkansas, *Environmental impact statements, *Springdale, Arkansas.

The Spring Creek project will be located in Washington County, Arkansas, and extend through the urban area of Springdale, Arkansas. Principal features of the plan are channel straightening and enlargement of about 9,000 feet of Spring Creek to provide flood protection against a 50-year frequency flood for the city of Springdale, Arkansas. One railway bridge and two street bridges will be replaced by new bridges. Three additional street bridges will be replaced by the concrete box channel, and another three street bridges will be removed. The project right-of-way will require 27 acres of land. Powerlines, telephone lines, pipelines, and sanitary sewerlines within the project area will require suitable relocation. Some selective clearing within construction limits will be necessary.
W71-13875

FLOOD PROTECTION ON CAYUGA ISLAND AT AND IN THE VICINITY OF LITTLE RIVER AND CAYUGA CREEK, NIAGARA COUNTY, NEW YORK.
Army Engineer District, Buffalo, N.Y.

Available from the National Technical Information Service as PB-198 745-D, $3.00 in paper copy, $0.95 in microfiche. Draft environmental statement, 4 Feb, 1971. 3 p.

Descriptors: *Flood control, *Environmental impact, *Storm drains, Sewers sedimentation, Irrigation, Reservoirs.
Identifiers: *Environmental surveys, *New York, Storm sewers, Environmental impact statements, *Niagara Falls, New York.

The proposed Brantley Project--a dam and reservoir development--is on the Pecos River in Eddy County about 20 miles upstream from Carlsbad, New Mexico. The development would provide replacement irrigation storage for the McMillan Reservoir which is losing its effectiveness because of sediment accumulation. The plan of development for the project consists of the construction of Brantley Dam and associated reaction and fish and wildlife facilities. The reservoir would have a total capacity of 520,000 acre-feet. There will be an inundation of some productive lands and wildlife habitat. The project would displace about 15 families and require purchase of 59 sets of improvements such as residential buildings, farmsteads, windmills, and irrigation pumps and ponds. The reservoir would inundate Major Johnson Springs, a historic locale in the area. These springs played an important part in the early history of the area.
W71-13876

NORTH NASHUA RIVER CHANNEL IMPROVEMENT, FITCHBURG, MASSACHUSETTS.
Corps of Engineers, Waltham, Mass. New England Div.

Available from the National Technical Information Service as PB-198 701-D, $3.00 in paper copy, $0.95 in microfiche. Draft environmental statement, 14 April 1971. 3 p.

Descriptors: *Channel improvement, *Environmental impact, *Streamflow, *Rivers, River regulation.
Identifiers: *Environmental surveys, *Massachusetts, Crib walls, *Fitchburg, Mass., *North Nashua River, *Environmental impact statements.

The proposed project is on the North Nashua River near Fitchburg, Massachusetts and extends with the river for a distance of about five miles. About 1937, work was done under a Work Relief Project to improve conditions in that reach of the river, and consisted mainly of installation of cribs and walls, and placement of grouted rip-rap, works which, over the years, have deteriorated extensively. This project proposes rehabilitation and/or reconstruction of those walls, cribs and grouted rip-rap. In addition, new work will be accomplished consisting of channel excavation for a distance of about 2,600 feet (about 20,000 cubic yards), and removal of channel obstructions and depositions. Rehabilitation and/or reconstruction of the extensively deteriorated cribs and walls and related facilities will improve the physical appearance of this urban area as well as control river flow. No adverse effects are anticipated.
W71-13877

SAXONVILLE LOCAL PROTECTION, FRAMINGHAM, MASS.
Corps of Engineers, Waltham, Mass. New England Div.

Available from the National Technical Information Service as PB 198 702-D, $3.00 in paper copy, $0.95 in microfiche. Draft environmental statement, 14 April 1971. 3 p.

Descriptors: *Environmental impact, *Flood control, *Dikes, *Levees, Sedimentation, Flood gates, Pumping plants.
Identifiers: *Massachusetts, Pumping stations, *Saxonville, Massachusetts, *Environmental impact statements.

The proposed project for Saxonville, Massachusetts is designed to prevent flooding by the Sudbury River of the important facilities and homes in the area. 2,900 feet of earth dike, 750 feet of concrete floodwalls, a vehicular flood gate, a railroad stoplog structure and a pumping station are proposed. In addition, a 1200-foot long section of the river channel will be straightened. In this manner, flood waters will be controlled and contained. The existing environment is generally manmade consisting of factories and similar structures. The construction will result in a temporary turbidity in the river. Some vegetation in the improvement area will be destroyed.
W71-13878

WILSON HARBOR, NEW YORK, 1968 PROJECT MODIFICATION.
Army Engineer District, Buffalo, N.Y.

Available from the National Technical Information Service as PB-198 708, $3.00 in paper copy, $0.95 in microfiche. Draft environmental statement, 22 Apr. 21, 1971. 3 p.

Descriptors: *Environmental impact, *Channel improvement, *Dredging, *Harbors, *Ships.
Identifiers: *Environmental surveys, *Environmental impact statements, *Wilson, New York.

1. Project description. The 1968 project modification provides for dredging of a 6-foot channel through Tuscarora Bay for the benefit of small-boat traffic. Under an earlier modification, the Federal government has built jetties in Lake Ontario at the mouth of the bay and dredged an entrance channel 8 feet deep from Lake Onatario, between the jetties and into the lower end of the bay. The 1968 modification joins the present channel and extends to the upper end of the bay. The extension is planned in connection with state park development in the area.
W71-13879

EL DORADO LAKE, KANSAS, PROJECT.
Corps of Engineers, Tulsa, Okla. Tulsa District.

Available from the National Technical Information Service as PB-198 732, $3.00 in paper copy, $0.95 in microfiche. Draft environmental statement, 21 Apr 1971. 27 p.

Descriptors: *Dams, *Reservoirs, *Environmental impact, *Flood control, Lakes, Kansas, Water supply, Relocation, Recreation.
Identifiers: *Environmental surveys, Construction, *Environmental impact statements, *El Dorado, Kansas, Walnut River, El Dorado Lake, *Endangered species, Prarie chickens.

Project description. The authorized El Dorado Lake will be located on Walnut River in Butler County, Kansas near the city of El Dorado. The project purposes are flood control, water supply, water quality control, and recreation. The project was authorized by the flood control Act of 1965, Public Law 89-298, 89th Congress and is presently in the postauthorization planning stage with a B/C ratio of 1.13. The dam at river mile 98.0 would be approximately 9,650 feet long, including the spillway, with a maximum height above the streambed of 88 feet. The capacity of the lake would be 167,500 acre-feet, of which 75,200 acre-feet would be allocated to flood control, 74,900 acre-feet to water conservation, and 17,400 acre-feet for inactive storage. The conservation storage would provide a dependable yield of 16.2 m.g.d. Approximately 11,700 acres of land would be involved in the acquisition program for the reservoir. The drainage area above the damsite is 235 square miles. The plan of development currently under consideration and being coordinated with others concerned would provide for full utilization of the stream yield. Consequently, the damsite would be adjusted upstream about one mile and the height of the dam raised one foot. With an increase in flood control and a greatly reduced inactive storage, the resulting conservation storage will be about double that in the authorizing document. An increase of approximately 5,400 acres of land is involved in the acquisition program currently being formulated. The drainage area of 234 square miles would provide a dependable yield of 6 m.g.d. greater than the authorized project.
W71-13880

PROBLEMS IN DEVELOPING A NATIONAL FLOOD-PROTECTION POLICY,
For primary bibliographic entry see Field 06B.
W71-13889

COMPUTER METHODOLOGY AND WATER RESOURCE DEVELOPMENT,
Metcalf and Eddy, Inc., Boston, Mass.
For primary bibliographic entry see Field 06A.
W71-13974

4B. Groundwater Management

SYSTEMS ENGINEERING AND WATER RESOURCES IN SOUTHERN NEVADA,
Nevada Univ., Reno. Center for Water Resources Research.
For primary bibliographic entry see Field 06A.
W71-13213

A DEVICE FOR MEASURING DOWN-HOLE PRESSURES AND FOR SAMPLING FLUIDS IN GEOTHERMAL WELLS,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 07B.
W71-13457

A DEVICE FOR COLLECTING DOWN-HOLE WATER AND GAS SAMPLES IN GEOTHERMAL WELLS,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 07B.
W71-13458

EFFECTS OF STIMULATION ON WELL OPERATING COSTS AND ITS PERFORMANCE ON OLD AND NEW WELLS,
Koenig (Louis) Research, Inc., San Antonio, Tex.
Louis Koenig.
Journal of American Water Works Association, Vol. 52, No. 12, p. 1499-1512, December, 1960. 3 fig., 10 tab., 4 ref.

Descriptors: *Water wells, *Aquifer characteristics, Groundwater, Wells, Specific capacity, Injection wells.
Identifiers: *Aquifer stimulation, Well operating costs, Old and new well performance, Power costs, Unit cost ratios.

The general conclusion drawn is that water well stimulation is a successful means of reducing lifting cost and that money spent on well treatment shows a comparatively high rate of return in reduced operating costs. In this article, it has been demonstrated that water well stimulation is a technically and economically feasible practice applicable to a wide variety of wells and aquifers. By means of stimulation, additional production can be obtained from existing facilities, the investment cost per unit production can be reduced, and the energy cost for lifting can likewise be reduced. These conclusions apply, regardless of whether the well is new or old or has been stimulated before. On the basis of these results it is recommended that serious consideration be given to the possibilities of well stimulation in each case before a new well is constructed, before a proposed well field is abandoned as uneconomical, before a newly constructed well is abandoned as being too low in production, and before an unsatisfactory old well is abandoned or subjected to drastic reconstruction. Water well stimulation should also be carefully evaluated for existing well fields where there may be a possibility of advantageously producing the desired total production more efficiently from a smaller number of wells, thus achieving lower capital investment and maintenance costs. (Campbell-NWWA)
W71-13710

GEOLOGY AND WATER WELL CONSTRUCTION,
Geological Survey, Norman, Okla. Ground Water Branch.
For primary bibliographic entry see Field 08A.
W71-13711

METHANE GAS IN WATER WELLS,
Bates Coll., Lewiston, Me. Dept. of Geology and Biology.
L. W. Fisher, and W. H. Sauyer, Jr.
Science, Vol. 113, No. 1, p. 7-8, January 5, 1951. 2 fig, 1 tab, 1 ref.

Descriptors: *Water wells, Groundwater, *Methane gas, Maine.
Identifiers: Special geologic conditions, Well cuttings, Bedding planes, Potential hazard.

Methane gas was discovered in small amount in a water well cable-drilled by the Steel and Hodgdon Company, of Auburn, Maine, about 3.2 miles northeast of the center of the village of Winthrop in Winthrop Township. No gasoline, fuel oil, or bottled gas tanks have been, or now are, located within seepage range of the well. There is no direct surface evident of faulting, which might give rise to a crush zone along which the gas could have migrated from its original source. There is a very minor amount of graphite in the local limestone (now limy phyllite). There is also calcite in the phyllite. Surface waters, acid in nature might conceivably attack the calcite and liberate carbon dioxice, but, under the conditions of temperature and pressure that exist, methane gas could not be formed. The writers know of no near-surface methane producing reactions that can take place between the constituent minerals of the rocks present and percolating waters. The most plausible explanation of this pocket methane gas is that the gas migrated along the counter plane between the two local formations or along the bedding planes of the phyllites from some near-by swamp areas, or entered the zone of the wellhole through fractures in the country rock. (Campbell-NWWA)
W71-13717

ECONOMIC ASPECTS OF WATER WELL STIMULATION,
Koenig (Louis) Research, Inc., San Antonio, Tex.
Louis Koenig.
Journal of American Water Works Association Vol. 52, No. 5, p. 631-637, May 1960. 3 fig., 1 ref.

Descriptors: *Water wells, Groundwater, *Aquifer characteristics, Specific capacity, Wells, Oil industry.
Identifiers: *Aquifer stimulation costs, Stimulation effectiveness, Fracturing, Shooting, Pressure acidizing, Vibratory explosions.

From the analysis of technical and economic data of the survey reported in this article, it is concluded

that water well stimulation has shown highly favorable results, not only in its technical performance, but also by the economic criterion chosen. In the majority of instances, stimulation has added specific capacity at a unit cost less than the unit cost of the specific capacity produced by the original well. The median cost of improvement of even the least favorable method by this economic criterion occurs at a unit cost less than half the unit cost of the original specific capacity. This is not only important in regions of existing ground water exploitation; it is equally applicable and possibly much more important to the large areas in which there are adequate quantities of ground water contained in aquifers of such low permeability that ground water production from wells has not been economical. Wider knowledge and application of water well stimulation can potentially bring about a greater utilization of this segment of ground water resources. Based on these analyses and results, the author recommends that ground water well stimulation be much more widely considered as a technique for developing ground water supplies. Such recommendations should not, however, be made without a simultaneous mention of a number of quite legitimate limitations to the benefits of water well stimulation. (Campbell-NWWA)
W71-13719

MODELLING A GROUNDWATER AQUIFER IN THE GRAND PRAIRIE OF ARKANSAS,
Arkansas Univ., Fayetteville. Water Resources Research Center.
Carl L. Griffis.
Paper No 71-205, presented at the Southwest Regional Meeting of ASAE, Western Hills Lodge, Okla., 4/1/71, 1971. 17 p, 6 fig, append. OWRR Project A-010-ARK (1).

Descriptors: *Mathematical models, *Groundwater, Aquifer characteristics, Recharge, Dredging, *Recharge wells, Model studies, Arkansas, *Artificial recharge.
Identifiers: *Grand Prairie (Ark).

A mathematical model has been developed for the Quaternary Aquifer of the Grand Prairie, Arkansas. The model is being used to test alternative methods of artificially recharging the aquifer. Two methods which have been tested are the dredging of Bayou Meto to encourage natural infiltration, and the construction of a system of recharge wells located in the central area of the Prairie. Results show that the dredging of the Bayou would not provide substantial relief from the groundwater shortage. The system of recharge wells, however, looks very promising.
W71-13811

GEOHYDROLOGY OF ATCHISON COUNTY, NORTHEASTERN, KANSAS,
Kansas Geological Survey, Lawrence.
John R. Ward.
Geological Survey Open-file report, 1971. 22 p, 6 fig, 3 plate, 1 tab, 12 ref.

Descriptors: *Groundwater, *Hydrogeology, *Water wells, *Hydrologic data, *Kansas, Water supply, Water quality, Aquifer characteristics, Geology, Water yield, Pumping, Withdrawal, Drawdown, Specific capacity.
Identifiers: *Groundwater resources, *Atchison County (Kans).

Data concerning groundwater resources in Atchison County, Kansas are presented. The unconsolidated Pleistocene deposits are the best potential sources of groundwater in the county. Because the Wisconsin terrace deposits and the alluvium are principally silt and clay throughout most of the county, yields are generally small. However, alluvium along the Missouri River is composed of very permeable sand and gravel from which well yields of 2,000 gpm are possible. An aquifer test in the alluvium showed a water-level drawdown of 11.3 feet after pumping 1,305 gpm continuously for 155 minutes. The specific capacity for the test was 115 gpm per foot of drawdown. The hydraulic conductivity was about 2,050 gpd per square foot. Four areas exist where water flows at the surface due to artesian pressure. Dissolved-solids concentrations throughout the county are generally high, but acceptable (less than 1,000 mg/liter). Concentrations greater than 1,000 mg/liter were found in water from thick glacial deposits. (Woodard-USGS)
W71-13842

PROSPECTS FOR DEVELOPING STOCK-WATER SUPPLIES FROM WELLS IN NORTHEASTERN GARFIELD COUNTY, MONTANA,
Geological Survey, Washington, D.C.
M. C. Van Lewen, and N. J. King.
Available from Sup Doc, GPO, Wash, D.C. 20402 - Price 75 cents. Geological Survey Water-Supply Paper 1999-F, 1971. 38 p, 6 fig, 1 plate, 7 tab, 14 ref.

Descriptors: *Montana, *Stock water, *Grasslands, *Groundwater, *Water wells, Hydrogeology, Springs, Subsurface waters, Alluvium, Geohydrologic units, Aquifers, Bedrock, Stratigraphy, Structural geology, Sedimentary rocks, Sandstones, Cattle, Conglomerate rocks, Water quality, Grazing, Domestic animals.
Identifiers: *Garfield County (Mont).

A practical and reliable source of livestock water exists on both public and privately owned grazing land in northeastern Garfield County, Montana. This comprises an area of some 1,200 square miles. The principal bedrock aquifer is the Fox Hills Sandstone formation of Upper Cretaceous age. It is exposed on the surface in the northern and northwestern part of the county and possesses a southeasterly dip of about 20 feet per mile. Wells penetrating this aquifer reach water at about 200 feet. Ample water is available for livestock use from wells drilled in this aquifer. Most of these wells reach the aquifer at 195 feet. Underflow in alluvial deposits along the larger stream valleys is another source of livestock water. Chemical analysis of samples collected at 43 wells and 3 springs show the water quality to be generally poor. Water from the Fox Hills aquifer and others associated with it contains 530-5, 340 milligrams per liter of total dissolved solids, while water from alluvium contains less than 1,500 milligrams per liter of total dissolved solids. The principal constituents are sodium, bicarbonate, and sulfate. All water supplies tested were suitable for livestock use. (Glasby-USGS)
W71-13844

OCCURRENCE OF GROUNDWATER IN KIMBALL COUNTY, NEBRASKA INCLUDING LOGS OF TEST HOLES,
Nebraska Univ., Lincoln, Conservation and Survey Div.
F. A. Smith, and V. L. Souders.
Nebraska Water Supply Paper No 29, June 1971. 135 p, 2 fig, 4 plate, append.

Descriptors: *Water resources development, *Groundwater, *Nebraska, *Aquifers, Aquifer characteristics, Water yield, Water wells, Alluvium, Water table, Hydrogeology, Data collections, Hydrologic data.
Identifiers: *Kimball County (Neb), *Ogallala Formation.

Two test-drilling programs were designed to explore the availability of groundwater in Kimball County, Nebraska. The objectives of the investigation were to determine the availability of groundwater and to map and describe the rocks in which it occurs. The test-hole information is also useful in an evaluation of soils, construction materials, oil and gas potential, and other geologic resources and their uses. This report includes logs of all the test holes drilled. Interpretation of information derived from the test drilling is presented on three maps and two geologic sections. The Ogallala Formation occurs throughout the county. The average thickness of the Ogallala Formation in the 52 test holes was 265 feet. Less than half the total volume of the Ogallala sediments contains water available to wells, and in some places the entire thickness of the formation is dry. Generally, the Brule is more deeply eroded in the northern part of the county and it is here that the Ogallala and the Arikaree sediments tend to be the thickest. Large-yield wells can be developed from water contained in the sand, gravel, and sandstone that fill the 'sags' and valleys eroded into the underlying Brule formation or older rocks. (Knapp-USGS)
W71-13845

ARTIFICIAL GROUND-WATER RECHARGE PROGRESS REPORT,
James A. Power, Jr.
Kansas Water News, Vol 14, p 8-15, Spring 1971. 7 fig.

Descriptors: *Groundwater recharge, *Groundwater movement, *Artificial recharge, *Kansas, Groundwater, Flooding, Seepage, Pit recharge, Recharge wells, Aquifer characteristics, Impounded waters.

Artificial recharge of groundwater is technically feasible in portions of western Kansas. In alluvial valleys, water spreading may recharge at a rate of one-tenth to five-tenths of a foot per day. Higher recharge rates may be expected in portions of the High Plains underlain by loess and the Ogallala formation. Recharge rates of one foot to over two feet per day have been obtained. Storm runoff may carry considerable quantities of clays, which when deposited, can have a major effect on recharge rates. The effect of biological activity in the summer may cause clogging of the soil and reduce the recharge rate. The recharge rate can be increased also by impounding the water and then letting the area dry. (Woodard-USGS)
W71-13847

GROUNDWATER MANAGEMENT IN DEVELOPMENT OF A NATIONAL POLICY ON WATER,
National Water Commission, Arlington, Va.
Leslie E. Mack.
Available from National Technical Information Service as PB-201 536, $3.00 paper copy, $0.95 microfiche. Report NWC-EES-71-004, Jan 31, 1971. 179 p, 3 plate, 3 ref.

Descriptors: *Groundwater, *Institutional constraints, *Surface-ground water relationships, *Water supply, Water wells, Groundwater recharge, Water pollution, Institutions, Manpower, *Reviews.

A general literature summary of groundwater management provides the basis for recommendations directed towards improving national water policies pertaining to groundwater. An outline is presented, in elementary language, of the importance of groundwater in the national water balance, some principles of groundwater-surface water relationships, and some aspects of groundwater hydrology and management. Efficient use of groundwater management is found to be constrained by data deficiencies, scarcity of broadly trained manpower, and institutional limitations. Several case studies illustrate a range of situations, including areas where recharge exceeds pumping and those where groundwater mining occurs. Pollution of aquifers is presented as a separate problem that is controllable. Comparison is made of the relative advantages and disadvantages of groundwater sources to surface sources. (Bowden-National Water Commission)
W71-13872

SUBSURFACE WASTE DISPOSAL BY MEANS OF WELLS--A SELECTIVE ANNOTATED BIBLIOGRAPHY,
Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 05E.
W71-13909

UNSTEADY DRAWDOWN IN WELL GROUPS,
Northwestern Univ., Evanston, Ill. Technological Inst.
R. J. Krizek, G. M. Karadi, and D. B. Rao.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY10, Paper 8436, p 1625-1638, October 1971. 7 fig, 2 tab, 3 ref, append.

Descriptors: *Drawdown, *Dewatering, *Unsteady flow, *Water wells, Drainage, Drainage engineering, Computer programs, Numerical analysis, Pumping, Groundwater movement, Seepage, Aquifers.
Identifiers: Well systems, Well arrays.

The unsteady drawdown response was analyzed and computer programs developed for a variety of well groups arranged in a two-line or rectangular array. The individual wells are assumed to fully penetrate a homogeneous, isotropic, artesian aquifer with constant hydraulic properties. The principle of superposition was used to develop a relationship for calculating the drawdown at any given point. An equivalent radius concept is introduced and quantified, and several graphical presentations are given to illustrate the relationship between different combinations of variables, which include well capacity, number of wells, well spacing, line spacing, and pumping time. A representative dewatering problem is included to demonstrate an application of the procedures developed. In general, these analytical and graphical procedures provide useful tools for the engineer who is charged with the responsibility of designing or analyzing the transient response of typical water supply or dewatering well systems. (Knapp-USGS)
W71-13918

EFFECTS OF GROUND-WATER DEVELOPMENT ON THE WATER REGIME OF PARADISE VALLEY, HUMBOLDT COUNTY, NEVADA, 1948-68, AND HYDROLOGIC RECONNAISSANCE OF THE TRIBUTARY AREAS,
Geological Survey, Carson City, Nev.
J. R. Harrill and D. O. Moore.
Nevada Division of Water Resources, Water Resources Bulletin No 39, 1970. 123 p, 18 fig, 1 plate, 24 tab, 42 ref.

Descriptors: *Water resources development, *Surface waters, *Groundwater, *Watershed management, *Nevada, Streamflow, Runoff, Aquifer characteristics, Withdrawal, Pumping, Water yield, Water quality, Chemical analysis, Water users, Irrigation, Surveys, Hydrologic data.
Identifiers: Humboldt County (Nev).

This study appraises water resources of the three areas in the Little Humboldt River drainage basin in Nevada: Little Humboldt Valley, Hardscrabble Area, and Paradise Valley. Emphasis is placed on evaluating effects of pumping groundwater in Paradise Valley on the hydrologic system. Estimates are made of inflow, outflow, system yield, decreed surface-water rights, annual use, and water still available for development. Chemical analyses for water samples are tabulated. Most of the water and related land development is in Paradise Valley, where during most years about 3,300 acres of cropland (primarily alfalfa hay) are irrigated by surface water and/or pumped groundwater; about 8,000 acres of native hay and pasture are irrigated by streamflow during the spring and early summer; and up to about 23,000 acres of mixed hay and low benefit phreatophytes are partially irrigated. As of spring 1969, permits to irrigate about 3,000 acres of land entirely by pumping groundwater and about 15,000 acres of land by pumping groundwater to supplement existing surface-water rights have been issued by the State Engineer. (Woodard-USGS)
W71-13934

GROUND WATER IN ECONOMIC DEVELOPMENT,
Utah State Univ., Logan. Coll. of Engineering.
Dean F. Peterson.
Ground Water, Vol 6, No 3, May-June 1968. 5 fig, 3 tab, 11 ref.

Descriptors: *Ground water, *Water supply, *Water resource, *Mining, *Overdraft, *Future planning, Quality control, Management, Technology.
Identifiers: *Ground water development, *Economic development, *Water resources planning, *Water resources management, Israel, West Pakistan, Tube well.

Ground-water development frequently provides a means whereby tremendous new economic opportunities are opened up. If supplies are overdrawn (mined) the ensuing regional economy may be able to afford replacements from more costly sources. Two cases are treated in the paper, Israel and West Pakistan. In Israel, besides furnishing more than half of the basic source of water supply, groundwater development provides opportunity for both quantity and quality management, which makes possible use of surface supplies and reclaimed sewage as firm rather than marginal sources. In West Pakistan initiation of ground-water development, first by the government and later by private enterprise, has, since 1960, led to construction of 3,500 governmental tube wells of about 3 cfs capacity and 30,000 private tube wells of slightly less than 1 cfs capacity. Results have been dramatic. Agricultural production and use of fertilizer are rapidly increasing, and opening of well development to private enterprise is providing the irrigator with benefits of free competition for his water custom which he did not previously enjoy. Ultimately, drainage and salinity problems will be mitigated if about 50 million acre-feet are pumped each year from ground water including about 28 million acre-feet to be mined from a reserve of about 1,900 million acre-feet. With some difficult surface storage development due to terrain, mining may eventually be reduced. (Strachan-Chicago)
W71-13959

NOTES ON THE EARLY HISTORY OF WATER-WELL DRILLING IN THE UNITED STATES,
Geological Survey, Tuscalossa, Ala.
For primary bibliographic entry see Field 08A.
W71-13966

WATER WELL DRILLER'S BEGINNING TRAINING MANUAL.
National Water Well Association, Columbus, Ohio.
For primary bibliographic entry see Field 08A.
W71-13973

4C. Effects on Water of Man's Non-Water Activities

URBANIZATION AND SEDIMENTATION - A BIBLIOGRAPHY.
Office of Water Resources Research, Washington, D.C. Water Resources Scientific Information Center.
For primary bibliographic entry see Field 02J.
W71-13432

STREET SALTING - URBAN WATER QUALITY WORKSHOP.
For primary bibliographic entry see Field 05B.
W71-13433

ROAD SALT AS A POLLUTING ELEMENT,
Bureau of Sport Fisheries and Wildlife, Fort Snelling, Minn.
For primary bibliographic entry see Field 05B.
W71-13440

PRECIPITATION DEPTH-DURATION-FREQUENCY RELATIONS FOR THE SAN FRANCISCO BAY REGION, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02B.
W71-13467

ORIGIN AND SEDIMENTOLOGY OF 1969 DEBRIS FLOWS NEAR GLENDORA, CALIFORNIA,
Geological Survey, Garden Grove, Calif.
For primary bibliographic entry see Field 02J.
W71-13468

FOREST SPECIES AS INDICATORS OF FLOODING IN THE LOWER WHITE RIVER VALLEY, ARKANSAS,
Geological Survey, Little Rock, Ark.
For primary bibliographic entry see Field 02I.
W71-13469

URBAN IMPACTS ON COASTAL ZONE MANAGEMENT,
Coastal Zone Resources Corp., Muskegon, Mich.
For primary bibliographic entry see Field 06B.
W71-13733

ENVIRONMENTAL IMPACT OF HIGHWAY DEICING,
Edison Water Quality Lab., N.J.
Ed Struzeski.
Copy available from GPO Sup Doc as SN-5501-0127, $1.25; microfiche from NTIS as PB-203 493, $0.95. EPA Program 11040 GKK 06/71.

Descriptors: Additives, Concrete structures, *Environmental effects, Groundwater, Water pollution effects, *Water pollution sources, *Highway icing, Plant physiology, Vegetation effects, Water supply, Salts, Corrosion, Runoff.
Identifiers: Urban runoff.

Deicing agents for removal of ice and snow from highways and streets are essential to wintertime road maintenance in most areas of the U.S. Due to the ever-increasing use of highway deicing materials, there has been growing concern as to environmental effects resulting from these practices. This State-of-the-Art report critically reviews the available information on methods, equipment and materials used for snow and ice removal; chlorides found in rainfall and municipal sewage during the winter; salt runoff from streets and highways; deicing compounds found in surface streams, public water supplies, groundwater, farm ponds and lakes; special additives incorporated into deicing agents; vehicular corrosion and deterioration of highway structures and pavements; and effects on roadside soils, vegetation and trees. Highway deicing can cause injury and damage across a wide environmental spectrum. Recommendations describe future research, development and demonstration efforts necessary to assess and reduce the adverse impact of highway deicing. (Struzeski-EPA)
W71-13898

A SOIL ERODIBILITY NOMOGRAPH FOR FARMLAND AND CONSTRUCTION SITES,
Agricultural Research Service, Lafayette, Ind. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02J.
W71-13910

EFFECT OF RECREATIONAL USE ON SOIL AND MOISTURE CONDITIONS IN ROCKY MOUNTAIN NATIONAL PARK,
A. D. Dotzenko, D. S. Romine, and N. T. Papamichos.
Journal of Soil and Water Conservation, Vol 22, No 5, September-October 1967. p 196-197, 6 fig, 1 tab, 4 ref.

Descriptors: *Soil properties, *Soil moisture, *Soils, *Recreation, Soil compaction, Erosion, Plant growth, Environment.

Identifiers: *Recreational areas, *Recreational use, Campgrounds, Rocky Mountain National Park.

As a result of the expanding population, increased income and leisure time, there has been more intensive use of outdoor recreational areas. Intensive use of recreation facilities generally causes deterioration of these sites. Soils are dynamic and change as their environment is modified. Ultimately, such soil modification which is caused by intensive use of recreational areas results in reduced plant growth, destroyed ground cover, increased soil compaction, decreased moisture infiltration rates and increased runoff and erosion. Environmental modification is more severe in a mountain area since soils are usually younger, shallower and more variable because of the diversity of conditions under which they were developed. Many recreational areas have been built without regard to the soils. Consequently, erosion and loss of plant life are important problems in many recreational areas. The area of study in this article is that of the Rocky Mountain National Park campgrounds. (Strachan-Chicago)
W71-13958

4D. Watershed Protection

URBANIZATION AND SEDIMENTATION - A BIBLIOGRAPHY.
Office of Water Resources Research, Washington, D.C. Water Resources Scientific Information Center.
For primary bibliographic entry see Field 02J.
W71-13432

TERRACES REDUCE RUNOFF AND EROSION ON SURFACE-MINE BENCHES,
Northeastern Forest Experiment Station, Berea, Ky.
W. R. Curtis.
Journal of Soil and Water Conservation, Vol 26, No 5, p 198-199, September-October 1971. 3 fig, 1 ref.

Descriptors: *Erosion, *Strip mines, *Erosion control, *Soil conservation, *Terracing, Rainfall intensity, Duration curves, Depth-area-duration analysis, Frequency analysis, Sampling, Gaging stations, Geologic control, Vegetation effects.

A two-year study in Breathitt County, Kentucky, shows that terraces can effectively control runoff and erosion on surface-mine benches. In an area where the soil was predominantly shale, peak flows on a terraced plot averaged 65% less than on the control plot, sediment yield averaged 52% less, and total runoff averaged 42% less. Comparable figures on a set of plots having substantial amounts of sandstone were 65, 70, and 6% respectively. Average storm runoff duration was 1% higher on the terraced plot of each pair. (Knapp-USGS)
W71-13913

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

THE PHYTOPLANKTON OF MINNESOTA LAKES - A PRELIMINARY SURVEY,
Minnesota Univ., Minneapolis. Water Resources Research Inst.
For primary bibliographic entry see Field 05C.
W71-13149

TURBIDITY INSTRUMENTATION: A FIBER-OPTIC SYSTEM FOR MEASURING SEDIMENT CONCENTRATION BY OPTICAL FOURIER TRANSFORMATION,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
Albert McSweeney.
Available from the National Technical Information Service as PB-202 985, $3.00 in paper copy, $0.95 in microfiche. Environmental Resources Center, Georgia Institute of Technology, ERC-0471, July 1971. 22 p, 6 fig, 4 ref. OWRR A-027-GA (1).

Descriptors: *Turbidity instrumentation, *Turbidity, *Sediments, *Sediment distribution, *Particle size, Optical measurement, Particle shape, Optical properties, Water pollution, Fourier analysis, Light intensity, Opacity.
Identifiers: *Fiber-optics, *Light-pipes.

Optical transformation techniques using a laser for illumination were investigated to measure sediment concentration in a water sample. An optical Fourier transformation system was set up with a bundle of fiber-optic light-pipes connected to an array of photo detectors for analyzing the transform of samples of known particle size distribution. Two of seven information channels of the fiber-optic bundle were used as a test. Intensity measurements from the test of two known monodisperse samples were used to generate a matrix of weight functions. The matrix was used to transform the measured intensity from a mixture containing two particle sizes which were different from the sizes used to determine the matrix. Results show that the system could not distinguish between 160 and 187 micrometer diameter particle but discriminated well between 276 and 321 micrometer diameter particles. Both size resolution and accuracy are expected to improve as more fiber-optic channels are used. (Conway-Georgia Tech)
W71-13167

MERCURY REGULATIONS.
Illinois Pollution Control Board, Springfield.
For primary bibliographic entry see Field 06E.
W71-13199

APPLICATIONS OF POLYMERS IN MARINE ECOLOGY,
Bologna Univ. (Italy). Ciamician Chemical Inst.
R. Muzzarelli.
Revue Internationale D'Oceanographie Medicale, Nice, France, Vol 21, p 93-108, 1971. 2 fig, 103 ref.

Descriptors: *Sea water, *Ions, *Ionization, *Marine animals, *Crustaceans, *Adsorption, Water pollution, Radioactivity effects, Ecology, Radiochemical analysis, Pollutant identification.
Identifiers: *Polymers, *Chitin, *Chitosan, Roentgenographic techniques.

Two natural polymers, chitin and chitosan were used to study interactions between ions present in sea water. Radiochemical and roentgenographic techniques were employed. Chitosan is deacetylated chitin and is prevalent in marine organisms, particularly in crustaceans. Data on the mechanism of ion adsorption of these polymers and values relating to their adsorption ability is presented. These polymers adsorb ions of transition metals but do not adsorb alkaline and alkaline-earth ions. All of these interactions are used for the analytical study of radioactive pollution and decontamination of sea water. (Ensign-PAI)
W71-13232

THE RADIO-ACTIVE CONTAMINATION OF THE SEA (LA CONTAMINATION RADIO-ACTIVE DE LA MER),
Centro Applicationi Militari Energia Nucleare, Pisa (Italy). Laboratoire de Radioprotection.
L. Argiero, and S. Manfredini.
Revue Internationale D'Oceanographie Medicale, Nice, France, Vol 21, p 45-73, 1971. 4 fig, 5 tab, 19 ref.

Descriptors: *Radioactive wastes, *Water pollution, *Sea water, *Sediments, *Radioisotopes, *Biological properties, Hydrograph analysis, Chemical analysis, Physical properties.
Identifiers: *Italian Seas.

The state of pollution from radioactive wastes in Italian seas is presented. Hydrographical, physical, chemical, and biological aspects are studied. The techniques used to measure the amounts of the various radio-isotopes are discussed with emphasis on the biological factors. Tables of the samples from stations along all the Italian coasts are given. An organization for controlling measures is proposed. (Ensign-PAI)
W71-13235

SIGNIFICANCE OF SEDIMENTS IN EVALUATING THE RADIOACTIVE CONTAMINATION OF THE SEA,
Parma Univ. (Italy). Istituto di Zoologia e Anatomia Comparata.
B. Schreiber.
Revue Internationale D'Oceanographie Medicale, Nice, France, Vol 21, p 27-43, 1971. 5 fig, 1 tab, 20 ref.

Descriptors: *Sea water, *Radioactivity, *Water pollution sources, *Sediments, Bioindicators, Radioisotopes, Cores, Fallout, Industrial wastes.
Identifiers: *Beta values, Ligurian Sea, Adriatic Sea, Taranto Gulf.

Various components of the environment have been considered possible indicators of contamination. Water, plankton, nekton, benthic faune and flora accumulate radionuclides according to their physical or metabolic characteristics. Sediments also reveal the presence of radionuclides after 'residence time' in suspension and solution. Comparisons between the beta values of fallout and fractions of core were made and showed a high correlation. Coastal sediment radioactivity in the Ligurian Sea, Northern Adriatic Sea and Taranto Gulf were studied for contamination from fallout and industrial wastes. The artificial radioactivity level in sediments was found to be low. Gross beta radioactivity measurements were conducted which confirmed that increases in the concentrations of the single nuclides corresponded to sensible variations in the gross beta value. This type measurement may be considered a fast and simple way to evaluate sea bottom contamination. (Ensign-PAI)
W71-13236

PHYSICOCHEMICAL STATES OF SOME TRACE ELEMENTS IN SEAWATER WHICH ARE OF INTEREST FROM THE RADIOCONTAMINATION STANDPOINT,
Comitato Nazionale per l'Energia Nucleare, La Spezia (Italy). Laboratorio per lo Studio della Contaminazione Radioattiva del Mare.
A. Piro.
Revue Internationale D'Oceanographie Medicale, Nice, France, Vol 20, 1970. p 133-149, 19 ref.

Descriptors: *Sea water, *Trace elements, *Physicochemical properties, *Radioactivity, Stable isotopes, Sediments, Marine organisms, Absorption, Trophic level.
Identifiers: *Isotopic dilution, *Concentration factor.

Marine biota have been found to take up the elements essential to their life, selecting them on the basis of their own physicochemical forms. Radioisotopes introduced into seawater and their permanence in relation to the physicochemical states of the radioisotope and the corresponding stable isotope in seawater, as well as to the physical, chemical and biological characteristics of the contaminated environment are discussed. The concept of isotopic dilution and the Concentration Factor, must be considered in relation to the above parameters because the physicochemical forms of the contaminating isotope may or may not enter in equilibrium with the other physicochemical states present. (Ensign-PAI)
W71-13238

THE MEASUREMENT OF OUR NATURAL RESOURCES,
New England Aquarium, Boston, Mass.

For primary bibliographic entry see Field 05C.
W71-13252

FERTILITY AND AQUATIC BIOMASS IN SOUTHEASTERN IMPOUNDMENTS,
Auburn Univ., Ala. Agricultural Experiment Station.
For primary bibliographic entry see Field 05C.
W71-13255

MEASURING THE INFLUENCE OF WATER-QUALITY CHANGES ON FISH,
California, Univ., Davis. Dept. of Animal Physiology; and Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05C.
W71-13262

SAMPLING THE BENTHOS,
Toronto Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W71-13267

MODELS OF AQUATIC ENVIRONMENT BIOASSAY,
Aquatic Sciences, Inc., Boca Raton, Fla.
For primary bibliographic entry see Field 05C.
W71-13271

DESIGN OF A SYSTEM FOR REMOTE POLLUTION RELATED MEASUREMENTS ON AN ESTUARY,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13276

AN EVOLUTIONARY RIVER MODEL VIA ON-LINE SYSTEM IDENTIFICATION,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13277

AN EVOLUTIONARY RIVER MODEL VIA CONTINUOUS ON-LINE SYSTEM IDENTIFICATION,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13278

A STUDY OF A WATER POLLUTION CONTROL SYSTEM TO MAINTAIN THE DISSOLVED OXYGEN STANDARD,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13279

A SYSTEM FOR REMOTE TELEMETRY OF WATER QUALITY DATA,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13281

ANALYSIS OF VARIATIONS IN DISSOLVED OXYGEN IN AN IMPOUNDMENT IN CENTRAL ILLINOIS,
Illinois State Water Survey, Peoria. Water Quality Section.
For primary bibliographic entry see Field 05B.
W71-13287

PHOTOMETRIC DETERMINATION OF SMALL AMOUNTS OF OXYGEN IN WATER WITH 3,3'-DIMETHYLNAPHTHIDINE,
Central Sewage Treatment Plant, Brno, (Czechoslovakia).
H. Fadrus, and J. Maly.
Analyst, Vol 96, No 1145, p 591-597, August 1971. 3 fig, 2 tab, 29 ref.

Descriptors: *Water quality control, *Water pollution control, *Water quality, *Chemical analysis, *Dissolved oxygen, Analytical techniques, Laboratory tests, Instrumentation.

A sensitive and precise method for the determination of small concentrations of dissolved oxygen in waters by photometric determination with 3,3'-dimethylnaphthidine is presented. This reagent in an acetic acid and mineral acid medium produces a red - violet color with multivalent manganese hydroxides, the intensity of which corresponds to Beer's law. Errors occurring in the isodimetric determination by Winkler's method are eliminated and interferences are usually removed simply by modifications to the procedure. For unpolluted waters the accuracy of the oxygen determination is satisfactory; for contaminated waters errors are caused by the presence of interferences analogous to those in Winkler's method. (Woodard-USGS)
W71-13292

NUTRIENT POPULATION EQUIVALENT OF DOMESTIC WASTE WATER,
Marquette Univ., Milwaukee, Wis. Dept. of Civil Engineering.
Colin J. McKenna.
Master's Thesis, September 1970. 55 p, 3 fig, 6 tab, 64 ref.

Descriptors: *Pollutant identification, Water pollution sources, *Domestic wastes, *Chemical analysis, *Analytical techniques, Statistical methods, Sampling, Chemicals, Nutrients, Urine, Organic matter, Detergents, *Nitrogen, *Phosphorus, Phosphates, Organic wastes.
Identifiers: Quantification, Feces.

Nitrogen and phosphorus have been linked as the principle contributors in speeding biological growths in receiving bodies of water. Recently, there has been an increase in the amount of the soluble biological nutrients, phosphorus and nitrogen, in waste waters due to man's more industrialized and affluent society, and the increase in the use of detergents. Quantification of the amount of nutrient constituents in a purely domestic waste water was thought necessary to discover the effect of man's waste on the environment. Nutrients in domestic waste result from feces and urine, detergent builders, waste food disposal, carriage water, and infiltration, the first three sources being most important. The domestic area used for this study had a population of 1,207. A total of 18 tests were run in which 24 hour samples were composited according to the measured flow. Total Kjeldahl nitrogen value obtained was an average of 5.3 pounds per capita per year. The per capita ammonia value was an average of 2.5 grams per day (the amount may fluctuate with the diet). Estimated total phosphorus concentration was between 2.4 and 3.5 pounds per capita per year, due about equally to synthetic detergents and human excretion. (Adkins-Texas)
W71-13322

TURBIDIMETRIC-CHROMATOGRAPHIC DETERMINATION OF PETROLEUM POLLUTION IN WATER,
Vsesoyuznyi Nauchno-Issledovatelskii Institut Vodosnabzheniya, Kanalizatskii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR).
L. S. Krivitskaya.
Hygiene and Sanitation, Vol 35, No 5, May 1970. p 239-243, 1 fig, 1 ref.

Descriptors: *Separation techniques, *Chromatography, Oil, Resins, Laboratory tests, Silica gels, Mixing, Filtration, Emulsions, Turbidity, Density, Colorimetry, Analytical techniques, Water quality control, Pollutant identification, Water pollution sources.
Identifiers: *Hydrocarbons, *Turbidimetry, Chloroform.

Waters containing various mixtures of petroleum products can now be analyzed using a method based on the chromatographic separation of petroleum hydrocarbons from other pollutants in a thin layer of silicagel. The isolated hydrocarbons are then determined turbidimetrically. In repeated experiments with pure substances, effluents, and river water, it was demonstrated that the presence of sewage and of natural components of water did not interfere with the determination of petroleum hydrocarbons. However, certain colored substances of industrial origin may interfere with the determination of the tarry fraction. The method can detect 0.3 mg hydrocarbons, 0.2 mg resins, and 0.1 mg asphaltenes per analytical sample of water. When tested on water samples containing 2 to 100 mg/l of artifically added petroleum products, the method produced relative errors of 1.5 to 21%. The procedure is fairly sensitive, however, the volatilization occurring during the chromatographic determination renders the method inapplicable to petroleum fractions of boiling point less than 250 deg, and to sulphonaphthenic and naphthenic acids. A complete description of procedures and expected results is given. (Lowry-Texas)
W71-13338

MAXIMUM PERMISSIBLE CONCENTRATION OF DIPROPYLAMINE IN WATER BODIES,
Sanitarno-Gigienicheskii Meditsinskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 05C.
W71-13339

ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE PROGRAM,
New Jersey, Dept. of Environmental Protection, Trenton. Bureau of Radiation Protection.
David McCurdy and John J. Russo.
Report May 1971. 10 fig, 18 tab, 20 ref.

Descriptors: *Environment, *Monitoring, *Aquatic life, *Surveys, Measurements, Instrumentation, Air pollution, Food chains, Milk, Radioactivity Effects, Nuclear powerplants, Regulation.
Identifiers: Radiation, Concentration, Administrative agency, Codes and standards.

The Bureau of Radiation Protection maintains an environmental radiation surveillance program for the purpose of providing current information on radioactivity levels in the environment. The surveillance program is a combination of a general statewide surveillance program, which includes the radioanalyses of foodstuffs, potable water, surface water, airborne particulates, and precipitation collected at established collection stations throughout the State, and the specific surveillance around nuclear facilities. A summary of the results of radioanalyses performed as part of the state-wide surveillance program is presented. The radioactivity levels measured in the various media sampled at the collection stations represent typical background ranges found throughout the State. (Houser-NSIC)
W71-13380

OPPORTUNITIES TO MONITOR POTENTIAL DOSE TO MAN FROM NUCLEAR EXCAVATION,
California Univ., Livermore. Lawrence Radiation Lab.
For primary bibliographic entry see Field 05C.
W71-13389

ANALYSIS OF ACTIVATED SLUDGE SEPARATION PROBLEMS,
Northwestern Univ., Evanston, Ill.
For primary bibliographic entry see Field 05D.
W71-13409

THE EFFECT OF HIGHWAY SALT ON WATER QUALITY IN SELECTED MAINE RIVERS,
Marine Univ., Orono. Dept. of Soil Science.

For primary bibliographic entry see Field 05B.
W71-13435

REMOTE SENSING BIBLIOGRAPHY FOR EARTH RESOURCES, 1969,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07B.
W71-13442

DIFFUSION OF SEWAGE EFFLUENT FROM OCEAN OUTFALL,
Louisville Univ., Kentucky. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 05B.
W71-13444

A MODIFIED SPECTROPHOTOMETRIC METHD FOR THE DETERMINATION OF AMMONIA (AND AMINO-ACIDS) IN NATURAL WATERS, WITH PARTICULAR REFERENCE TO SEA WATER,
East African Marine Fisheries Research Organization, Zanzibar (Tanzania).
For primary bibliographic entry see Field 02K.
W71-13447

WATER QUALITY BUOY TESTED IN BAY.

Oceanology International, Vol 6, No 8, p 18, August 1971. 1 p.

Descriptors: *Water quality, *Data collections, *Remote sensing, *Bays, *Rhode Island, Instrumentation, Telemetry, Analytical techniques, Water analysis, Water temperature, Dissolved oxygen, Hydrogen ion concentration, Estuaries, Chemical analysis.
Identifiers: *Real-time data, *Narragansett Bay (RI).

A water quality monitoring buoy, installed in Narragansett Bay, R.I., in February 1971, has been in almost continuous operation since its installation. Installed with sensors for temperature, dissolved oxygen, and pH, the buoy has provisions for 10 more sensors. Data are multiplexed and digitized in the buoy for error-free transmission. The buoy is part of the water quality monitoring system for EPA's National Marine Water Quality Laboratory (NMWQL). Consisting of the subsurface buoy, a shore station, and a laboratory station, the system provides real-time data on water quality parameters in the bay to NMWQL facilities in West Kingston, R.I., via submarine cable and leased phone lines. The installation is providing a continuous record of water quality parameters in the complex estuary and invaluable data on long-term in-situ sensor performance at the same time. (Woodard-USGS)
W71-13451

DETERGENTS IN THE STREAMFLOW OF SUFFOLK COUNTY, LONG ISLAND, NEW YORK,
Geological Survey, Mineola, N.Y.
For primary bibliographic entry see Field 05B.
W71-13464

NITRATE AND ORTHOPHOSPHATE IN SEVERAL NEBRASKA STREAMS,
Geological Survey, Lincoln, Nebr.
For primary bibliographic entry see Field 05B.
W71-13465

BIOKINETIC EVALUATION OF BOD CONCEPTS AND DATA,
Engineering Science, Inc., Oakland, Calif. Research and Development Lab.
For primary bibliographic entry see Field 05D.
W71-13523

STATISTICAL EXPERIMENTAL DESIGN: BOD TESTS,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
Paul M. Berthouex, and William G. Hunter.
Journal, Sanitary Engineering Division of the American Society of Civil Engineers, Vol 97, No. SA 4, August 1971, p 393-407, 6 fig, 2 tab, 10 ref.

Descriptors: *Systems analysis, *Biochemical oxygen demand, *Kinetics, Statistical methods, Mathematical models, Analytical techniques, Design data, Industrial wastes, Municipal wastes, Nitrification, Water analysis.
Identifiers: *Box-Lucas Method, Robustness, Replication.

Inefficient designs for wastewater treatment plants, resulting from ignorance of actual BOD conditions have spurred the development of an experimental design technique. Although this technique was applicable to many different types and complexities of equations, the BOD equation was chosen for use as an example. A mathematical model was chosen, f (k, xi sub mu, in which xi sub mu)are variables and k — vector of parameters, and assumed to be correct. It was further assumed that: (1) the purpose of the experiment was to select settings for the variables in order to obtain the most precise estimates of k; and (2) that the experimental variables can be accurately set and controlled. The use of matrix algebra allowed the designer to determine which of the ranges of values for the parameters was limiting. Knowledge of these ranges for the various variables allowed the experiment to be designed around the most important ranges, thereby reducing unnecessary work by obtaining only the precise information desired. The use of replicate operations was examined, as were the problems of lag reactions and nitrification. The procedure is readily extensible to more complex models, actually gaining in accuracy as complexity increases. (Lowry-Texas)
W71-13528

TESTING THE TOXICITY OF EFFLUENTS TO FISH,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 05C.
W71-13537

POTABILITY CLASSIFICATION OF GROUNDWATERS IN ARID ZONE OF WESTERN RAJASTHAN,
Indian Defence Lab., Jodhpur.
For primary bibliographic entry see Field 02K.
W71-13577

WATER POLLUTION IN THE GREATER NEW YORK AREA-SYMPOSIUM.
For primary bibliographic entry see Field 05B.
W71-13624

WATER QUALITY OF THE NEW YORK HARBOR AND BIGHT AREAS,
Environmental Protection Agency, Edison, N.J., Hudson-Delaware Basins Office.
For primary bibliographic entry see Field 05B.
W71-13628

WATER CHEMISTRY OF THE LOWER HUDSON RIVER.
New York Univ., Medical Center, N.Y. Lab. for Environmental Studies.
For primary bibliographic entry see Field 05B.
W71-13629

WATER QUALITY SURVEILLANCE IN NEW YORK STATE,
New York State Dept. of Health, Albany. Div. of Pure Water.
For primary bibliographic entry see Field 05B.
W71-13631

ECONOMIC AND ENGINEERING ASPECTS OF WATER IN DELAWARE'S AGRI-BUSINESS INDUSTRY,
Delaware Univ., Newark. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 05B.
W71-13658

EVALUATING WASTE DISPOSAL AT SEA -- THE CRITICAL ROLE OF INFORMATION MANAGEMENT,
Bisset-Berman Corp., San Diego, Calif.
For primary bibliographic entry see Field 05E.
W71-13726

YEASTS AS AN INDICATOR OF POLLUTION,
Laval Univ. (Quebec). Dept. of Food Sciences.
R. E. Simard.
Marine Pollution Bulletin, Vol 2, No 8, August 1971, p 123-125. 3 fig, 2 tab, 10 ref.

Descriptors: *Pollutants, *Yeasts, *Indicators, Water pollution effects, Aquatic microbiology, Warning systems, St. Lawrence River, Water analysis, Aquatic fungi.
Identifiers: *Pollution indicators.

A survey of yeast populations at various points along the St. Lawrence River indicates that certain yeast blooms occur after bacteria have degraded the easily metabolizable constituents of raw sewage and that their numbers could be used as an indicator of pollution. (Currer-PAI)
W71-13747

DETECTION BY SATELLITE,
North Atlantic Treaty Organization, Brussels (Belgium). Div. of Scientific Affairs.
For primary bibliographic entry see Field 05G.
W71-13759

CORYNEFORM BACTERIA IN POULTRY DEEP LITTER,
Edinburgh Univ. Dept. of Bacteriology.
H. E. Schefferle.
Journal of Applied Bacteriology, Vol 29, No 1, 1966. p 147-160, 2 tab, 57 ref.

Descriptors: *Bacteria, *Poultry, Farm wastes, Hydrogen ion concentration, Laboratory procedure, Decomposing organic matter, Biodegradation, Salt tolerance, Organic acids, Ureas, Vitamin B, Ammonia, Genetics, Classification, Pollutant identification, Waste treatment.
Identifiers: *Coryneform bacteria, Litter, Uric acid, Biochemical characteristics, Growth factors, Deep litter, Build up litter.

A detailed discussion of bacteria found in poultry litter is presented. The most frequently occurring bacteria in poultry litter is the coryneform. The paper discusses the characteristics and classification of the coryneform bacteria isolated during the investigation. The procedures for isolating and differentiation of the various strains is discussed. The actual counts of coryneform bacteria in the region 10 to the 9th power - 10 to the 11th power/g of fresh material did not appear to be related to the physical conditions of the litter. Three hundred and eleven strains of coryneform bacterial were examined and compared to those found in poultry litter. (Hazen-Iowa State)
W71-13789

ADENOSINE TRIPHOSPHATE CONTENT OF SELENASTRUM CAPRICORNUTUM,
Wisconsin Univ., Madison. Dept. of Soil Science; and Wisconsin Univ., Madison. Water Chemistry Lab.
For primary bibliographic entry see Field 05C.
W71-13794

WATER MONITORING SYSTEM.
Cordis Corp., Miami, Fla. Cordis Labs.

Available from the National Technical Information Service as PB-203 426, $3.00 in paper copy, $0.95 in microfiche. Terminal Progress Report, March, 1970, 34 p, 9 fig, 6 tab. EPA 16030 ENR 03/70. Contract 14-12-412.

Descriptors: *DDT, *Malathion, *Pesticides, *Antibiotics (Pesticides), Public health, Pollutant identification.
Identifiers: DDA, *Immunization, Immunoassay.

The feasibility of producing antibodies to DDT and Malathion derivatives was accomplished by immunizing animals with pesticide-protein complexes in which the protein carrier was derived from the species being immunized. DDA-rabbit serum albumin or Malathion anhydride-rabbit serum albumin cojugates were injected into rabbits in complete Freund's adjuvants at multiple intradermal sites, and antibody responses were encountered by the third or fourth injection. The results demonstrate that (1) it is possible to develop specific antibodies to two pesticide derivatives, DDA and Malathion anhydride (2) these antibodies are highly specific for each pesticide derivative' and (3) given enough time, the technical difficulties which have been encountered in utilizing these antibodies for the development of a highly sensitive immunoassay procedure could be resolved. Such a technique would offer investigators interested in pollution problems a simultaneously highly specific and highly sensitive method for detecting and measuring these pesticides, without the need for preliminary treatment of the samples being investigated.
W71-13813

PROBABILISTIC ANALYSIS OF DISSOLVED OXYGEN,
Colorado State Univ., Fort Collins, Dept. of Civil Engineering.
I. I. Esen.
Ph.D. Thesis, Colorado State University, March 1971. 104 p, 11 fig, 5 tab, 29 ref, 5 append.

Descriptors: *Probability, Oxygen demand, *Dissolved oxygen, *Water pollution effects, *Statistical models, Variability, Reaeration, Statistics, Statistical methods, Biochemical oxygen demand, Model studies, Monte Carlo method, Stochastic processes.
Identifiers: *Dissolved oxygen model.

Equations are developed which predict the mean values of biochemical oxygen demand and dissolved oxygen concentration at any point downstream from the point of addition of wastes to a river. The equations account for the effects of deoxygenation, reaeration, waste addition, oxygen addition, sedimentation of solids to the river bottom, and benthal demand, but neglect the effects of longitudinal dispersion, variations in stream discharge and the effects of photosynthesis. Variations in the values of the coefficients of the differential equations, in particular coefficients of deoxygenation and reaeration, are examined by using data collected by the Ohio River-Cincinnati Pool Survey and Tennessee Valley authority. The coefficients of deoxygenation and reaeration were considered to be normally distributed. The probability distribution of biochemical oxygen demand was obtained analytically by developing a random walk model. To determine the probability distribution of dissolved oxygen, a Monte Carlo technique was developed. Variances and confidence limits of dissolved oxygen levels thus obtained were compared with the data obtained from samples taken from the Sacramento River. (Knapp-USGS)
W71-13852

THE ANALYSIS OF LEAD AND ZINC IN NATURAL WATERS BY THE 'SAMPLING BOAT' TECHNIQUE,
Missouri Univ., Rolla, Dept. of Geology.
N. H. Tibbs, and E. A. Bolter.
Missouri University Department of Geology Research Report, 1971. 9 p, 4 fig, 2 ref. OWRR Project B-021-M0- (5).

Descriptors: *Chemical analysis, *Heavy metals, *Spectrophotometry, *Water chemistry, *Analytical techniques, Instrumentations, Sampling, Natural streams.
Identifiers: *Lead, *Zinc, *Atomic absorption spectrophotometry.

Stream samples were analyzed for lead and zinc using a Perkin-Elmer Model 303 Atomic Absorption Spectrophotometer. The Perkin-Elmer Sampling Boat accessory was used with tantalum boats. An aliquot of the sample is placed in a tantalum boat, evaporated to dryness, and the boat is placed directly in the flame. The readily volatilized elements are consumed in 1-2 seconds. This rapid consumption results in a high, narrow absorption peak, thereby yielding significantly lower detection limits. The Sampling Boat technique is valuable for the determination of lead and zinc at extremely low concentrations in natural water. It is limited in zinc analysis in that at concentrations above 20 micrograms per liter excessively small aliquots must be delivered to the boats with a resulting decrease in accuracy. (Lang-USGS)
W71-13907

5B. Sources of Pollution

CYCLING OF ZINC-65 BY COLUMBIA RIVER PERIPHYTON IN A CLOSED LOTIC MICROCOSM,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
Colbert E. Cushing, and Fred L. Rose.
Limnol Oceanogr. 15 (5): 762-767, Illus, 1970.
Identifiers: Algae, Columbia, Cultures, Cycling, Lotic, Microcosm, Periphyton, Plant, River, USA, Zinc-65.

Studies of 65Zn cycling by periphyton were performed in a closed, lotic microcosm under varying light regimes, community state, initial ambient concentrations, and stable divalent cation concentrations. Uptake of 65Zn was considerable in continuous light, continuous darkness, a 12-hr photoperiod, or by killed communities, indicating a dominant adsorptive uptake mechanism. Uptake of 65Zn was shown to be proportional to the initial ambient concentration of 65Zn, which decreased during the course of an experiment. Increasing of the concentration of stable zinc or Mg proportionately decreased the uptake of 65Zn, illustrating a competition for binding sites and supporting the adsorptive uptake theory. A discussion of the significance of this work to the reporting of concentration factors is presented. The similarity in function between the heterogeneous periphyton community and unialgal cultures or single species of plants is pointed out.–Copyright 1971, Biological Abstracts, Inc.
W71-13102

DISSOLVED PHOSPHORUS CONCENTRATIONS IN A NATURAL SALT-MARSH OF DELAWARE,
Univ. Ga., Mar. Inst., Sapelo Island, Ga., 31327, Georgia Univ., Sapelo Island. Marine Inst.
For primary bibliographic entry see Field 02L.
W71-13124

THE PHYTOPLANKTON OF THE HUNGARIAN REACH OF THE DANUBE DURING THE WINTER MONTHS (DANUBIALIA HUNGARICA, XLVI.),
Magyar Tudomanyos Akademia, Budapest. station for Danube Research.
For primary bibliographic entry see Field 05C.
W71-13130

CHEMICAL EFFECTS OF DECOMPOSING SALMON CARCASSES ON AQUATIC ECOSYSTEMS,
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 05C.
W71-13142

THE LAND AND WATER CONSERVATION AND RECLAMATION ACT.
For primary bibliographic entry see Field 06E.
W71-13160

SUPERVISION OF OIL, GAS, AND NATURAL DRY GAS WELLS.
For primary bibliographic entry see Field 06E.
W71-13214

LIQUID INDUSTRIAL WASTES.
For primary bibliographic entry see Field 06E.
W71-13222

EVALUATION TESTS OF THE TRANSFER OF RADIOACTIVE POLLUTION IN THE OCEANIC AND MARINE FOOD CHAINS, (ESSAI D'EVALUATION DES TRANSFERTS DE LA POLLUTION RADIOACTIVE DANS Les chaines alimentaires oceaniques et marines),
Commissariat a l'Energie Atomique, Fontenay-aun-Roses (France).
For primary bibliographic entry see Field 05C.
W71-13234

THE RADIO-ACTIVE CONTAMINATION OF THE SEA (LA CONTAMINATION RADIO-ACTIVE DE LA MER),
Centro Applicationi Militari Energia Nucleare, Pisa (Italy). Laboratoire de Radioprotection.
For primary bibliographic entry see Field 05A.
W71-13235

SIGNIFICANCE OF SEDIMENTS IN EVALUATING THE RADIOACTIVE CONTAMINATION OF THE SEA,
Parma Univ. (Italy). Istituto di Zoologia e Anatomia Comparata.
For primary bibliographic entry see Field 05A.
W71-13236

DIVISION OF MINERAL RESOURCES.
For primary bibliographic entry see Field 06E.
W71-13240

RADIONUCLIDES AS POSSIBLE SEA WATER POLLUTANTS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco); and CNEN-EURATOM Lab., Fiascherino (Italy).
S. Keckes, and M. Bernhard.
Revue Internationale D'Oceanographie Medicale, Nice, France, Vol 20, 1970, p 9-28. 55 ref.

Descriptors: *Sea water, *Pollutants, *Radioisotopes, *Nuclear wastes, *Industrial wastes, Speciation, Equilibrium, Waste dilution, Dispersion, Diffusion, Advection, Environmental effects, Food chains.
Identifiers: *Natural radionuclides, *Man-made radionuclides.

Radionuclides released as by-products from nuclear power plants, installations for production of nuclear fuel and weapon tests are polluting the marine environment. The marine biogeocycle of the radionuclides and their corresponding stable elements are outlined. The physico-chemical speciation and equilibration with the corresponding stable element; dilution and dispersion by diffusion and advection; transport from the point of entry by currents; migrating organisms and concentration by organisms directly from sea water or through food chains and by physico-chemical processes leading finally to removal by sediments are discussed. Somatic and genetic damage to marine organisms and to man has become a hazard. The risk of marine radioactivity is being seriously weighed against the benefits of the atomic age. (Ensign-PAI)
W71-13244

APPLICATIONS OF THE HORTON STREAM CLASSIFICATION TO EVALUATE FAUNAL STUDIES,
Kentucky Univ., Lexington. Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W71-13269

A RIVER AS A CHEMICAL REACTOR,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13272

THE HARMONIC ANALYSIS OF THE PENOBSCOT RIVER TIDES,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13274

THE DETERMINATION OF THE RATES OF DIFFUSION OF DISSOLVED OXYGEN IN SALINE WATERS,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13275

AN EVOLUTIONARY RIVER MODEL VIA ON-LINE SYSTEM IDENTIFICATION,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13277

AN EVOLUTIONARY RIVER MODEL VIA CONTINUOUS ON-LINE SYSTEM IDENTIFICATION,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13278

MIXING IN SELF-SUSTAINED TURBULENCE,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13283

BEHAVIOR OF GAS BUBBLES IN AQUEOUS ELECTROLYTE SOLUTIONS,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13284

ANALYSIS OF VARIATIONS IN DISSOLVED OXYGEN IN AN IMPOUNDMENT IN CENTRAL ILLINOIS,
Illinois State Water Survey, Peoria. Water Quality Section.
V. Kothandaraman, and R. L. Evans.
Water Resources Research, Vol 7, No 4, p 1037-1044, August 1971. 8 fig, 2 tab, 11 ref.

Descriptors: *Dissolved oxygen, *Time series analysis, *Impoundments, Lakes, Water quality, Water temperature, Reservoirs, Impounded waters, Reservoir stages, Data collections, Sampling, Thermal stratification, Fourier analysis, Statistical methods, Variability, Illinois.
Identifiers: Dissolved oxygen variation, *Lake Bloomington (Ill).

Spectral analysis was employed to investigate the nature of variations in dissolved oxygen concentrations in Lake Bloomington by using an 18-month record of weekly observations. At the deepest portion of the lake, seasonal changes with a periodicity of 4 months are significant; this corroborates findings based on chemical water quality changes. The results of spectral analysis of DO records at 0.61-meter depth of different stations in the lake are similar. The upper layers of the entire lake respond alike to the changes in DO concentrations. Long-term and random variations in the observations are thought to be the predominant features of the DO record. The limiting depth of the epilimnetic zone in the lake, as defined by temperature and DO, appears to be about 6.10 meters. (Knapp-USGS)
W71-13287

NATURAL OIL SEEPS IN OR NEAR THE MARINE ENVIRONMENT: A LITERATURE SURVEY,
Coast Guard, Washington, D.C. Applied Chemical Oceanography Branch.
T. C. Johnson.
Available from NTIS, Springfield, Va. 22151 as AD723310 - $3.00 printed copy. Coast Guard Office of Research and Development Background Report, March 1971. 30 p, 8 fig, 40 ref. No 714141/002.

Descriptors: *Oil, *Seepage, *Oil-water interfaces, *Water pollution sources, Documentation, Oceans, Research facilities, Planning, Pollutant identification, Monitoring, Marine geology.
Identifiers: *Literature survey, Marine oil seeps, Western Hemisphere.

A literature survey was conducted to determine where naturally occurring oil seeps have been reported to be injecting oil into the sea. The purpose of this was to locate natural laboratories where fate and behavior studies on oil in the marine environment might be conducted. Emphasis was placed upon seeps in the northern half of the Western Hemisphere. Results of these studies will contribute to the establishment of a logical marine pollution monitoring program by the U.S. Coast Guard. Of the locations determined, those which are most likely to be useful for planned Coast Guard studies are: near Barter Island, Alaska; southern California; western Newfoundland; and in the Gulf of Paria west of Trinidad. (Lang-USGS)
W71-13297

NUTRIENT POPULATION EQUIVALENT OF DOMESTIC WASTE WATER,
Marquette Univ., Milwaukee, Wis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05A.
W71-13322

TURBIDIMETRIC-CHROMATOGRAPHIC DETERMINATION OF PETROLEUM POLLUTION IN WATER,
Vsesoyuznyi Nauchno-Issledovatelskii Institut Vodosnabzheniya, Kanalizatskii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR).
For primary bibliographic entry see Field 05A.
W71-13338

MERCED DREDGING CO V MERCED COUNTY (CONSTITUTIONALITY OF ORDINANCE REQUIRING RESTORATION AFTER DREDGE MINING.
For primary bibliographic entry see Field 06E.
W71-13375

UNDERSTANDING THE DYNAMIC BEHAVIOR OF RADIONUCLIDES RELEASED TO THE ENVIRONMENT AND IMPLICATIONS,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 05C.
W71-13376

RECENT ADVANCES IN APPLICATIONS OF ISOTOPES AND RADIATION IN THE UNITED STATES,
Atomic Energy Commission, Washington, D.C. Div of Isotopes Development.
E. E. Fowler.
Available from Unipub, Inc. P.O. Box 433, New York, N.Y. 10016. In: Fourth United Nations International Conference on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, September 6-16, 1971, p 4.5-2--4.5-19. 2 tab, 47 ref.

Descriptors: *Radioactivity techniques, *Radioisotopes, *Path of pollutants, Stable isotopes, Neutron activation analysis, Analytical techniques, On-site investigations, Water pollution sources, Air pollution, Subsurface investigations, Mapping, Locating, Clathrates, Oxygenation, Rivers, Sand waves, Sediment transport, X-ray fluorescence, Snowfall, Precipitation gages.
Identifiers: Mercury, Krypton radioisotopes, Californium radioisotopes.

About 25% of the paper concerns application of radioactivity techniques to environmental pollution. Neutron activation analysis is used to measure mercury pollution in the field, and to 'finger print' the source of petroleum pollution. Radio-isotope X-ray fluorescence is an extremely sensitive method for analysis with air filters. The Tsivoglou method of measuring the oxygen consumption of rivers is based on the loss of kryton-85 dispersed in a water-soluble clathrate. Sulfur dioxide pollution is studied by isotope methods using mass-spectroscopic determination of the sulfur-32/sulfur-34 ratio. Automobile exhaust is analyzed by counting the kryton-85 released by three kryptonated reactants; specific for carbon monoxide, hydrocarbons, and nitrogen oxides, respectively. Other environmental systems are snowgages, a shipboard computer system for detecting movement of tagged sand; and on-site neutron activation exploration for minerals on the ocean floor (including vanadium, manganese, indium, gold, and silver. Medical uses, industrial measurements, radiation processing, food irradiation, and radiation detector development are also discussed. (Bopp-NSIC)
W71-13377

DISTRIBUTION OF RADIONUCLIDES IN BOTTOM SEDIMENTS OF THE COLUMBIA RIVER ESTUARY,
Geological Survey, Washington, Oreg.
D. W. Hubbell and J. L. Glenn.
Available from the National Technical Information Service as TID-25724, $3.00 in paper copy, $0.95 in microfiche. Open File Report, Portland, Oregon, 1971. 136 p, append.

Descriptors: *Effluents, *Nuclear powerplants, *Estuaries, *Estuarine environment, *Radioisotopes, Sediments, Deposition (Sediments), Radioactive waste disposal, Nuclear wastes, Streambeds, Pacific Ocean, Cores, Gamma rays, Particle shape, Particle size, Soil physical properties, Settling velocity.
Identifiers: Sediment distribution, Radiation.

Radionuclides produced primarily by neutron activation of naturally occurring stable element and chemical additives in nuclear-reactor coolant water are discharged into the Columbia River at the Hanford Reservation of the United States Atomic Energy Commission. In the river, the radionuclides associate with sediment and biota or remain in solution and subsequently are distributed downstream throughout the river system and the Columbia River estuary to the Pacific Ocean. To provide information on the distribution of radioactivity in the estuary, the physical and radiological character of the streambed was investigated in 1965. Gross-gamma radiation was measured in situ and surficial samples and cores were obtained with specially designed equipment at 14 cross sections between Longview, Wash., near Columbia River mile 65.8, and the estuary mouth. (Houser-NSIC)
W71-13378

BIO-MEDICAL DIVISION PRELIMINARY REPORT FOR PROJECT SCHOONER,
California Univ., Livermore. Lawrence Radiation Lab.
L. R. Anspaugh, R. J. Chertok, and B. R. Clegg.
Available from National Technical Information Service as UCRL-50718, $3.00 paper copy; $0.95 microfiche. Biomedical Division Preliminary Report for Project Schooner, July 22, 1969. 75 p, 49 fig, 15 tab, 23 ref.

Descriptors: *Nuclear explosion, *Excavation, *Environmental effects, *Biological communities, *Aquatic life, *Ecology, *Ecosystems, Air pollution, Water pollution, Soil contamination, Tritium, Fallout, Surveys, Forecasting, Meteorology, Atmosphere.
Identifiers: Concentration, Nuclear detonation, Peaceful uses, Surveillance program, Plowshare.

The Schooner-Event was a 31-kiloton nuclear cratering detonation executed on 8 Dec. 1968 at the Nevada Test Site. The Bio-Medical Division participated in this event in a variety of ways concerned with prediction, transport, and interaction with the biosphere. The predictive effort considered those radionuclides created within the device and its environment with the aim of identifying those with the greatest biological hazard. During and immediately following the event a variety of field experiments were conducted. Aircraft samples of the cloud were analyzed to determine radionuclide and mass partitioning as a function of particle size and class. Fourteen sequential air-sampling stations were fieled to study the distribution and redistribution of airborne particles up to 6 weeks following the event. With debris collected from the base-surge cloud as well as with crater-lip material, experimenters are determining the biological availability of radionuclides to pigs, cows, and various aquatic organisms. This report summarizes preliminary findings and indicates the direction of continuing efforts. An ecology program was begun in the immediate vicinity to study the half-residence-times of radionuclides in soils, plants, and animal life. (Houser-ORNL)
W71-13379

ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE PROGRAM,
New Jersey, Dept. of Environmental Protection, Trenton. Bureau of Radiation Protection.
For primary bibliographic entry see Field 05A.
W71-13380

STUDY OF THE PARAMETERS OF RADIOCOBALT TRANSFER IN CONTINENTAL AQUATIC AND IRRIGATED ECOSYSTEMS,
Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
For primary bibliographic entry see Field 05C.
W71-13381

TRANSPORT OF CESIUM-137. INTERACTION WITH BED SEDIMENTS,
Texas Univ., Austin. Dept. of Civil Engineering.
Akira Kudo, and Earnest F. Gloyna.
Water Research, Vol 5, pp 71-79 (1971). 4 fig, 3 tab, 11 ref. AEC contract AT- (11-1)-490.

Descriptors: *Radioisotopes, *Sediment transport, *Absorption, Model studies, River flow, Tracer, Path of pollutants, Radioactivity effects, Water pollution effects, Cores, Bottom sediments, Flumes, Weirs, Sorption, Absorption, Lake soil.
Identifiers: Cesium radioisotopes.

Cesium-137 uptake by Lake Austin sediments (which are particularly cohesive) was studied in aquaria and model rivers. In a non-flowing system the penetration of radioactivity was less than 2-3 particle diameters in 24 hours, and the ratio of the rate of radioactivity uptake per sec, square cm of bed to the radioactivity content per cubic cm water equaled 5 x 10-5 cm/sec. The rate of radioactivity uptake by sediment increased 180 fold as the mean fluid velocity was increased from 0 to 50 cm/sec. The ratio of radioactivity transport in sediment to that in water increased from 0 to 2 as the fluid velocity was increased from 5 to 50 cm/sec. Desorption of radioactivity by sediment was less than 1% per month at a fluid velocity of 3 cm/sec. (Bopp-NSIC)
W71-13386

HEALTH PHYSICS ASPECTS OF NUCLEAR FACILITY SITING SUMMARY OF CONFERENCE NO. 701106,
Health Physics Society.
For primary bibliographic entry see Field 05C.
W71-13390

AN ESTIMATE OF RADIATION DOSES RECEIVED BY INDIVIDUALS LIVING IN THE VICINITY OF A NUCLEAR FUEL REPROCESSING PLANT IN 1968,
Bureau of Radiological Health, Winchester, Mass. Northeastern Radiological Health Lab.
For primary bibliographic entry see Field 05C.
W71-13391

PUBLIC HEALTH ASPECTS OF I-129 FROM THE NUCLEAR POWER INDUSTRY,
Bureau of Radiological Health, Rockville, Md; and Iowa State Univ., Ames. Dept. of Chemistry.
For primary bibliographic entry see Field 05C.
W71-13392

QUANTITATIVE EVALUATION OF ENVIRONMENTAL FACTORS AFFECTING POPULATION EXPOSURE NEAR HANFORD,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05C.
W71-13394

IN SITU MEASUREMENTS OF ENVIRONMENTAL RADIOACTIVITY,
Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 05C.
W71-13395

THE USE OF STABLE ELEMENT CONCENTRATIONS IN THE PRE-OPERATIONAL ENVIRONMENTAL MONITORING,
Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 05C.
W71-13397

A RECAPITULATION OF EFFLUENT RELEASES AND RELATED CHANGES IN BACKGROUND RADIATION LEVELS AT BROOKHAVEN NATIONAL LABORATORY, AND SOME COMPARISONS WITH THOSE ASSOCIATED WITH NUCLEAR POWER REACTOR PLANTS,
Brookhaven National Lab., Tenn.
For primary bibliographic entry see Field 05C.
W71-13398

RADIOIODINE DISTRIBUTION IN THE TARAPUR POWER REACTOR ENVIRONMENT DURING COMMISSIONING AND INITIAL OPERATIONS,
Tarapur Atomic Power Station (India).
For primary bibliographic entry see Field 05C.
W71-13399

PLUTONIUM CONCENTRATION IN ORGANISMS OF THE ATLANTIC OCEAN,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05C.
W71-13401

MANMADE RADIONUCLIDES IN THE HUDSON RIVER ESTUARY,
New York Medical Center, New York. Inst. of Environmental Medicine.
For primary bibliographic entry see Field 05C.
W71-13402

PAYING FOR POLLUTION BY THE POUND.
For primary bibliographic entry see Field 06E.
W71-13415

STREET SALTING - URBAN WATER QUALITY WORKSHOP.

Street Salting-Urban Water Quality Workshop Proceedings, Hawkins, R. H., ed, State University College of Forestry at Syracuse Univ May 6, 1971: Syracuse, N Y, State College of Forestry, July 1971. 94 p.

Descriptors: *Water pollution sources, *Water pollution effects, *Deicers, *Highway icing, *Water quality, Surface waters, Groundwater, Lakes, Sodium chloride, Calcium chloride, Surface runoff, Seepage, Data collections, Cities, Urbanization.
Identifiers: *Urban hydrology.

The 12 papers included in this volume concerning water pollution and related environmental effects from highway deicers, were given at the Street Salting - Urban Water Quality Workshop, held at the State University College of Forestry at Syracuse University, on May 6, 1971. Current annual use of highway deicers is around 9 million tons of sodium chloride, about one-third million tons of calcium chloride, and about 8 million tons of abrasives. Leading states in deicer use are Pennsylvania, Ohio, New York, Michigan, and Minnesota. Specific data and information are presented regarding: (1) Methods, equipment and materials used for snow and ice removal ; (2) chlorides found in rainfall and municipal sewage during the winter; (3) salt runoff from streets and highways; (4) deicing compounds found in surface streams, public water supplies, groundwater, farm ponds and lakes; (5) special additives incorporated into deicing agents; (6) vehicular corrosion and deterioration of highway structures and pavements; and (7) effects on roadside soils, vegetation and trees. (See also W71-13434 thru W71-13441) (Woodard-USGS)
W71-13433

ENVIRONMENTAL IMPACT OF HIGHWAY DEICING,
Environmental Protection Agency, Edison, N.J. Water Quality Lab.
E. J. Struzeski, Jr.
In: Street Salting-Urban Water Quality Workshop Proceedings, State University College of Forestry at Syracuse University May 6, 1971: Syracuse, N Y, State College of Forestry, p 14-19, July 1971.

Descriptors: *Water pollution sources, *Water pollution effects, *Deicers, *Highway icing, Reviews, Surface runoff, Cities, Sodium chloride, Calcium chloride, Seepage, Water quality, Surface waters, Groundwater, Water wells, Chemical analysis, Urbanization.
Identifiers: *Urban hydrology.

The effect of highway deicing on the environment is reviewed. Current annual use of highway deicers is around 9 million tons of sodium chloride, about one-third million tons of calcium chloride, and about 8 million tons of abrasives. Leading states in deicer use are Pennsylvania, Ohio, New York, Michigan and Minnesota. Serious groundwater pollution has occurred in many locations, due to the heavy application of salts onto highways. The State of New Hampshire up to 1965, had replaced more than 200 roadside wells, due to contamination by road salts. Some of these wells contained in excess of 3,500 mg/liter chlorides. Tastes and odors in domestic water supplies in Connecticut have been traced to chlorides and sodium ferrocyanide originating from salt storage areas. Within Massachusetts, salt increases have been noted in the water supplies of some 63 communities, and various supplies have been abandoned, at least in part due to road salting and salt storage piles. (See also W71-13433) (Woodard-USGS)
W71-13434

THE EFFECT OF HIGHWAY SALT ON WATER QUALITY IN SELECTED MAINE RIVERS,
Marine Univ., Orono. Dept. of Soil Science.
F. E. Hutchinson.
In: Street Salting - Urban Water Quality Workshop Proceedings, State University College of Forestry

at Syracuse University, May 6, 1971: Syracuse, N Y, State College of Forestry, p 20-23, July 1971. 3 tab.

Descriptors: *Water pollution sources, *Water pollution effects, *Deicers, *Highway icing, *Maine, Rivers, Surface waters, Sodium chloride, Surface runoff, Water quality, Chemical analysis, Data collections, Cities, Urbanization.
Identifiers: *Urban hydrology.

Seven rivers in Maine were sampled in April, July and October for a two-year period to determine the effect of highway salting on water quality. The water samples were analyzed for content of sodium and chloride ions. Four of the rivers selected were from the southwestern section of the state because of the relatively high road density and consequent salt usage in that area. Three rivers were from the eastern section of the state where there are few roads. Sodium and chloride concentrations were highest in the rivers in the southwestern part of the state (Androscoggin, Kennebec, Penobscot, Saco), but the concentration never exceeded 11 ppm of either ion. The levels in April at the time of snowmelt were lower (1-4 ppm) than in October. The determinations of sodium and chloride concentrations are tabulated. (See also W71-13433) (Woodard-USGS)
W71-13435

ROAD SALT AS AN URBAN TRACER,
Lamont-Doherty Geological Observatory, Palisades, N.Y.
W. S. Broecker, B. Schwartz, N. Sloan, and P. Ancona.
In: Street Salting - Urban Water Quality Workshop Proceedings, State University College of Forestry at Syracuse University, May 6, 1971: Syracuse, N Y, State College of Forestry, p 24-38, July 1971. 7 fig, 2 tab, 1 ref.

Descriptors: *Water pollution sources, *Water pollution effects, *Deicers, *Highway icing, *New York, New Jersey, Surface waters, Groundwater, Sodium chloride, Calcium chloride, Chemical analysis, Data collections, Water quality, Cities, Urbanization.
Identifiers: *Urban hydrology.

The effects of road salting on the quality of waters in the suburban area northwest of New York City were studied. The area studied is the drainage basin of the Hackensack River which lies on the west side of the Hudson River and constitutes much of Rockland County, N.Y. and Bergen County, N.J. The total amount of salt added to the roads of Bergen County in the winter of 1969-70 was 150,000 tons. The area of this county is 600 sq km, the rainfall 75 cm/yr, and the percent of water running off to the sea is about 50. If the road salt from the 1969-70 winter were uniformly dissolved in the runoff water for one year, the average chloride ion concentration would be 40 ppm. Adding the background level of about 10 ppm thus gives 50 ppm for the expected mean annual chloride concentration. The average 1970 value observed for the chloride ion content of Oradell reservoir, through which much of the drainage from Rockland and Northern Bergen County passes, was 40 ppm. The predicted and observed values are not significantly different. (See also W71-13433) (Woodard-USGS)
W71-13436

EFFECTS OF ROAD SALT ON A VERMONT STREAM,
New England Watershed Research Center, Burlington, Vt.
S. H. Kunkle.
In: Street Salting - Urban Water Quality Workshop Proceedings, State University College of Forestry at Syracuse University, May 6, 1971: Syracuse, N Y, State College of Forestry, p 48-61, July 1971. 6 fig, 5 tab, 15 ref.

Descriptors: *Water pollution sources, *Water pollution effects, *Deicers, *Highway icing, *Vermont, Streams, Sodium chloride, Calcium chloride, Surface runoff, Seepage, Water quality, Chemical analysis, Data collections, Surface waters, Cities, Urbanization.
Identifiers: *Urban hydrology.

Studies were made in the Sleepers River basin of Vermont during 1968 to 1970 to determine the effects of road deicers on water quality. Streams not influenced by the highway averaged 2 to 5 mg/liter chloride, while concentrations in the stream affected by the highway were about an order of magnitude higher. Salt concentrations in the highway-influenced stream peaked during summer baseflow. Some of the winter's salt apparently contaminated the soil, emerging later in groundwater inputs into the stream. Chloride concentrations in individual seeps sampled near the highway exceeded 200 mg/liter. Annual salt (NaCl) 'background' yields averaged 2.5 metric tons/sq km/yr for control catchments. The basin containing the highway yielded about 75 tons total in excess of background delivery. Since an estimated 67-100 tons of salt was applied within the watershed, much of the salt apparently appeared in the streamflow. (See also W71-13433) (Woodard-USGS)
W71-13438

STREET SALTING AND WATER QUALITY IN MEADOWBROOK, SYRACUSE, NEW YORK,
State Univ. of New York, Syracuse. Coll. of Forestry.
R. H. Hawkins.
In: Street Salting - Urban Water Quality Workshop Proceedings, State University College of Forestry at Syracuse University, May 6, 1971: Syracuse, N Y, State College of Forestry, p 62-69, July 1971. 5 fig, 2 tab.

Descriptors: *Water pollution sources, *Water pollution effects, *Deicers, *Highway icing, *New York, Cities, Data collections, Surface runoff, Seepage, Sodium chloride, Chemical analysis, Calcium chloride, Water quality, Streams, Surface waters, Urbanization.
Identifiers: *Urban hydrology, Syracuse (NY).

Analysis of water samples in Meadowbrook, which drains approximately 3.8 square miles of southeastern Syracuse, New York show that the application of street salt has a profound effect on water quality in the stream. The chloride content of the water varies greatly with the seasons. In late summer, chlorides average 60-80 ppm. Following the first snows and initial street salting, chlorides rise to about 200-300 ppm. Further salting runs concentrations even higher, and an extreme of 10,650 ppm was observed in December of 1969, although 'peak' highs of 1000-3000 ppm are more representative. The chloride concentrations taper off with the onset of summer, but still remain abnormally high, suggesting that some of the previous winter's salt is turning up in the streamflow. Not all the salt applied runs off with the water at the first opportunity. The salt finds its way into the soils, groundwater and street masonry. (See also W71-13433) (Woodard-USGS)
W71-13439

ROAD SALT AS A POLLUTING ELEMENT,
Bureau of Sport Fisheries and Wildlife, Fort Snelling, Minn.
R. W. Sharp.
In: Street Salting - Urban Water Quality Workshop Proceedings, State University College of Forestry at Syracuse University, May 6, 1971: Syracuse, N Y, State College of Forestry, p 70-73, July 1971. 5 ref.

Descriptors: *Water pollution sources, *Water pollution effects, *Deicers, *Highway icing, *Water quality, Lakes, Streams, Surface waters, Sodium chloride, Ecology, Surface runoff, Seepage, Water wells, Data collections, Cities, Chemical analysis, Urbanization, Wisconsin.
Identifiers: *Urban hydrology, Ecological effects.

The use of salt for snow and ice control on northern streets and highways has grown rapidly since the 1940's. In the winter of 1964-65, the City of Milwaukee, Wisconsin, used 33,000 tons of sodium chloride and 200 tons of calcium chloride. In the same winter, the Wisconsin Highway Department used 160,000 tons of sodium chloride, or 15.8 tons per mile of highway. The chlorides, being highly soluble, are carried by runoff water to lakes and streams. The question arises as to possible damage to the aquatic and terrestrial environment. Environmental effects appear to be localized near large urban centers and along heavily used freeway routes. Diamond Lake, in Hennepin County, Wisconsin, which receives the discharge of a major storm sewer, now has a chloride content of 2,270 ppm, equivalent of 3,780 ppm sodium chloride. To place these values in the perspective of fish tolerance, bluegills will tolerate 10,000 ppm, sodium chloride. Rainbow trout sustained 20% mortality at 12,000 ppm. A build-up of sodium chloride can cause complete soil sterility. Studies show a substantial build-up in chloride content of domestic wells located adjacent to main highway systems. Chloride levels exceeding the potable water supply standard of 250 ppm have been found in many states during recent years as a result of road salt application. (See also W71-13433) (Woodard-USGS)
W71-13440

EFFECT OF URBAN SALT RUNOFF ON LAKE STRATIFICATION,
State Univ., of New York Coll. at Oswego. Lake Ontario Environmental Lab.
J. H. Judd.
In: Proceedings of Symposium on Street Salting-Urban Water Quality Workshop, State University College of Forestry at Syracuse University, May 6, 1971: Syracuse, N Y, State College of Forestry, p 74-91, July 1971. 1 fig, 1 tab, 2 ref.

Descriptors: *Water pollution sources, *Water pollution effects, *Deicers, *Highway icing, *Water quality, *Lakes, Sodium chloride, Surface runoff, Seepage, Water analysis, Data collections, Cities, Urbanization.
Identifiers: *Urban hydrology, *Lake stratification.

The effect of runoff water from street deicing on the stratification within a small lake is described. First Sister Lake lies within the western limits of Ann Arbor, Washtenaw County, Michigan. It is of glacial origin and is surrounded on all sides by hills. An extensive subdivision has developed along the eastern and southeastern shore of the lake. A 2-lane highway is located on the hill to the north, with a 4-lane highway, Interstate 94, adjacent to it. The streets of the subdivision were paved in 1963 and storm sewers were installed. The storm sewers carry runoff water from 34.8 ha (84 acres) of the subdivision directly into First Sister Lake through five outfalls. The major factor inhibiting the spring mixing of First Sister Lake appeared to be greater density differences between upper and lower strata due to the amount of salt entering the lake during the previous winter. This in turn depended on the amount of snowfall and on the amount of salt which was used for deicing. High density water entering the lake tended to flow along the bottom and to settle in the deepest area of the lake. This layer of water of greater density increased the stability sufficiently to prevent mixing of the lower 3 or 4 m (9.8 to 13.1 ft). (See also W71-13433) (Woodard-USGS)
W71-13441

DIFFUSION OF SEWAGE EFFLUENT FROM OCEAN OUTFALL,
Louisville Univ., Kentucky. Dept. of Mechanical Engineering.
R. E. Stewart, H. D. Putnam, R. H. Jones, and T. N. Lee.
ASCE Proceedings, Journal of the Sanitary Engineering Division, Vol 97, No SA 4, Paper 8340, p 485-503, August 1971. 8 fig, 6 tab, 12 ref, append.

Descriptors: *Path of pollutants, *Coliforms, *Florida, *Ocean currents, *Waste dilution, Dispersion, Mixing, Water pollution sources, Atlantic Ocean.
Identifiers: Ocean outfalls.

Full scale diffusion experiments were conducted during August and December 1968 to estimate coliform bacteria concentration patterns of sewage effluent from an ocean outfall located at Pompano Beach, Florida. The experiments included measurements of near-shore currents, estimates of turbulent diffusion of the sewage effluent dye tracer studies, and the determination of natural die-off rate of coliform bacteria. Near-shore currents are predominately towards the North with fluctuations in speeds produced by the meandering of the Florida Current, by wind and tidal effects, and by inlet waters. For the travel times of interest, diffusion reduces concentration by a factor of 1000 or more. Coliform bacteria die-off rates were approximately two orders of magnitude greater during the summer months than during the winter. A model was developed to predict downstream concentrations patterns and the results can be used to assess future ocean outfall installations. (Knapp-USGS)
W71-13444

INVESTIGATION OF SINKING METHODS FOR REMOVAL OF OIL POLLUTION FROM WATER SURFACES, PHASE 1: SURVEY OF THE STATE-OF-THE-ART,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 05G.
W71-13452

PLANT NUTRIENTS AND THE ESTUARY MECHANISM IN THE DUWAMISH RIVER ESTUARY, SEATTLE, WASHINGTON,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 02L.
W71-13459

DETERGENTS IN THE STREAMFLOW OF SUFFOLK COUNTY, LONG ISLAND, NEW YORK,
Geological Survey, Mineola, N.Y.
P. Cohen, D. E. Vaupel, and N. E. McClymonds.
Geological Survey Research 1971, Chapter C, Professional Paper 750-C, p C210-C214, 1971. 4 fig, 1 tab, 6 ref.

Descriptors: *Detergents, *Base flow, *New York, *Surface-groundwater relationships, *Path of pollutants, Pollutant identification, Water wells, Groundwater movement, Alkylbenzene sulfonates, Linear alkylate sulfonates, Water pollution sources, Urbanization.
Identifiers: *Suffolk County (NY).

In 1962-69, the average MBAS (methylene-blue active substance) content of 46 streams in Suffolk County, Long Island, N.Y., was, on a yearly basis, approximately inversely related to the amount of streamflow. This relation partly reflected (1) the close similarity between the quality of the shallow groundwater and the quality of the streamflow, coupled with the dilution effect of recharge from precipitation on the quality of the shallow groundwater, (2) areal differences in the MBAS content of the shallow groundwater and the effects of these differences on the quality of the streamflow as the headwaters of the streams shifted in response to the 1962-66 drought, and (3) the substitution of LAS (linear alkylsulfonate) for ABS (alkylbenzene-sulfonate) in 1965. The average MBAS content and load of the streams in 1962 were virtually the same as in 1969. However, during the same period the average chloride content and load of the streams increased. (Knapp-USGS)
W71-13464

NITRATE AND ORTHOPHOSPHATE IN SEVERAL NEBRASKA STREAMS,
Geological Survey, Lincoln, Nebr.
R. A. Engberg.
GPO. Washington, D.C. 20402-Price $2.75. Geological Survey Research 1971, Chapter C, Professional Paper 750-C, p C215-C222, 1971. 4 fig, 4 tab, 4 ref.

Descriptors: *Phosphates, *Nitrates, *Streamflow, *Nebraska, *Water pollution sources, Discharge (Water), Farm wastes, Fertilizers, Path of pollutants, Nutrients, Land use, Eutrophication.

Analytical data for sampling sites on 11 streams in Nebraska indicate mean concentrations of nitrate ranging from 0.6 to 6.1 mg/liter and mean concentrations of orthophosphate ranging from 0.35 to 2.0 mg/liter. Weighted by water discharge, average concentrations of nitrate and orthosphosphate in all 11 streams were 2.1 mg/liter and 0.81 mg/liter, respectively. Concentrations of nitrate and orthosphsophate do not correlate with total dissolved-solids content of the water nor with water discharge. However, nitrate concentrations show some correlation with population density, cattle density, and percentage of drainage area planted to corn. (Knapp-USGS)
W71-13465

OCCURRENCE OF PHOSPHORUS AND NITROGEN IN SALT CREEK AT LINCOLN, NEBRASKA,
Geological Survey, Lincoln, Nebr.
R. A. Engberg, and T. O. Renschler.
GPO. Washington, D.C. 20402-Price $2.75. Geological Survey Research 1971, Chapter C, Professional Paper 750-C, p C223-C227, 1971. 1 fig, 2 tab, 11 ref.

Descriptors: *Water pollution sources, *Phosphates, *Nitrates, *Nebraska, Urbanization, Cities, Storm runoff, Sewage, Waste water disposal, Path of pollutants, Storm drains, Detergents, Eutrophication, Algae, Nutrients.
Identifiers: *Urban runoff, Urban hydrology, Lincoln (Nebr).

Concentrations of phosphorus and nitrogen in Salt Creek increase markedly in the 6-mile reach of the creek within the city of Lincoln, Nebr. Most of the increase is due to inflow from the Lincoln sewage-treatment plant and from storm-sewer and other urban runoff entering the reach. The city contributes average amounts of 0.94 tons phosphorus and 1.8 tons nitrogen per day to the stream, indicating annual per capita contributions of phosphorus and nitrogen of 4.5 and 8.7 pounds per year, respectively. (Knapp-USGS)
W71-13466

A NOTE ON THE SOLUBILITY OF OXYGEN IN WATER,
New Brunswick Univ., Fredricton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02K.
W71-13508

A STATE-OF-THE-ART REVIEW OF METAL FINISHING WASTE TREATMENT.
Batelle Memorial Inst., Columbus, Ohio. Columbus Labs.
For primary bibliographic entry see Field 05D.
W71-13514

WENDTLANDT V. NATIONAL CO-OPERATIVE REFINERY ASS'N (SALT WATER INTRUSION RESULTING FROM OIL DRILLING OPERATIONS).
For primary bibliographic entry see Field 06E.
W71-13521

PICKENS V HARRISON (JURY INSTRUCTIONS IN SUIT FOR DAMAGES TO IRRIGATION WELL CAUSED BY SALT WATER POLLUTION FROM OIL WELL).
For primary bibliographic entry see Field 06E.
W71-13534

POLZIN V. NATIONAL CO-OP REFINERY, (OIL POLLUTION OF DEEP WATER WELL).
For primary bibliographic entry see Field 06E.
W71-13538

WATER QUALITY RELATIONSHIPS IN THE RIVER SYSTEM,
Water Pollution Research Lab., Stevenage (England).
J. H. N. Garland, and I. C. Hart.
Paper 3A, Symposium on Trent (River) Programme, University of Nottingham, 15-17 April 1971. 16 p, 12 fig, 6 tab, 11 ref, (Water Pollution Research Laboratory, Reprint No. 621).

Descriptors: *Water management, *Water quality control, *River systems, *Sewage effluents, Surface run-off, Sampling, River flow, *Nitrification, Water purification, Model studies, Costs, Water pollution sources, *Effluent streams.
Identifiers: Trent River (England), Economic models.

To determine, for the purposes of the Trent Economic Model, the cost of achieving desired qualities of water in the river system and the influence of any proposed scheme of expenditure on the use that would be made of the river, a means must be found of relating water quality to the quality of effluents admitted to the stream. A major problem in forecasting the effects of pollution on a river system is inadequate sampling of water quality and flow. Water quality of the Trent River is dominated by one tributary, the Tame. Pollution within this tributary is greater than that attributed to normal effluent discharges. Account must therefore, be taken of storm run-off. Inorganic nitrogen mass flows are due mainly to sewage effluents in urban areas and to surface run-off in rural areas. Nitrification is an important means of river self-purification in the summer. River flow data and sewage effluent discharge data are required for effective management of water quality. (Goessling-Texas)
W71-13543

RUSCH V PHILLIPS PETROLEUM CO. (LIABILITY OF OIL COMPANIES FOR POLLUTING UNDERYLING STRATA),
For primary bibliographic entry see Field 06E.
W71-13593

GULF OIL CORP V. MILLER, (OIL POLLUTION OF DAIRY DRINKING WATER).
For primary bibliographic entry see Field 06E.
W71-13595

TOXIC FACTORS IN ENZYMES USED IN LAUNDRY PRODUCTS,
Rockefeller Univ., New York.
For primary bibliographic entry see Field 05C.
W71-13604

THE ECONOMICS OF SEWAGE DISPOSAL IN A COASTAL URBAN AREA-A CASE STUDY OF THE MONTEREY PENINSULA, CALIFORNIA,
California Univ., Berkely. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 05G.
W71-13605

WATER POLLUTION IN THE GREATER NEW YORK AREA-SYMPOSIUM.

Gordon and Breach, New York, N.Y., 1970. 211 p.

Descriptors: *Water quality, Water pollution effects, *Water pollution, *New York, Model studies, Surveys, Water pollution control, Water quality control, Water chemistry, Data collections, Reviews, Estuaries, Coastal plains.
Identifiers: *New York City.

The related problems of environmental pollution and population growth have become matters of overwhelming national concern. In and around New York City these problems are especially important because approximately ten percent of the nation's population and a correspondingly large concentration of industry, which together generate a huge volume of waste products daily are concentrated there. To this is added waste discharged by ships using the harbor. The city has a long history of responsible waste management, and as a result, pollution problems are not as severe as those in some other areas. This symposium, entitled 'Water Pollution in the Greater New York Area', discusses the problem. The topics discussed include the physical oceanography of New York Bight, path of pollutants in continental shelf areas, coastal zone hydrogeology, water quality in the New York City area, water chemistry in the lower Hudson River, chemical pollution, bioindicators, aquatic microbiology, water quality surveys, water quality models, and waste water treatment. (See also W71-13625 thru W71-13631) (Knapp-USGS)
W71-13624

THE PHYSICAL OCEANOGRAPHY OF THE NEW YORK BIGHT,
New York Univ., Bronx.
R. Hollman.
In: Water Pollution in the Greater New York Area - Symposium, Gordon and Breach, New York, N.Y., p 3-12, 1970. 3 fig, 9 ref. ONR Contract Nonr 285 (57).

Descriptors: *Water circulation, *Continental shelf, *Ocean currents, *New York, Path of pollutants, Currents (Water), Oceanography, Water temperature, Winds.
Identifiers: *New York Bight.

The general circulation in the New York Bight is characterized by a residual drift to the Southwest. Inshore of the 30 fathom curve, there is a residual drift of the bottom waters toward the harbor entrances. The temperature distribution is governed largely by seasonal variations. Maximum surface temperatures occur in August, with minimum values occuring in February. The vertical distribution in winter is almost isothermal. In summer, however, unusually large temperature gradients are encountered due to the cold bottom waters in the area. These are the cause of the anomalously cold surface waters occasionally encountered close to the shores. The occurrence of these cold surface waters along the beaches can be correlated with the local wind systems. (See also W71-13624) (Knapp-USGS)
W71-13625

SOME COMMENTS ON THE FACTORS INFLUENCING THE SPREAD OF POLLUTANTS IN SHELF WATERS,
Lamont-Doherty Geological Observatory, Palisades, N.Y.
A. L. Gordon.
In: Water pollution in the Greater New York Area - Symposium, Gordon and Breach, New York, N.Y., p 13-22, 1970. 3 fig, 7 ref.

Descriptors: *Water circulation, *Sea water, *Estuaries, *Continental shelf, *Mixing, Path of pollutants, Water quality, Water chemistry, Currents (Water), Oceanography, Rivers, Reviews.
Identifiers: *New York Bight.

The introduction of pollutants into the Hudson River Estuary and New York Bight is degenerating the quality of the environment to an extent which can no longer be tolerated. To control the spread of pollutants in shelf waters, a realistic advection-diffusion model is suggested. This model should reflect such non-steady components of the circulation pattern as: varying river discharge, tidal currents, shifting patterns and seasonal changes in water structure. This can be accomplished through data collection, use of known data, and by distribution of a fine gridwork of monitoring sensors. Knowledge of the distribution of the natural tracers (conservative and non-conservative) is necessary for our understanding of the spectra of turbulence. This area is influenced by the surface runoff of the large river systems of the Hudson and Connecticut Rivers and numerous smaller systems and no doubt large supplies of groundwater also directly enter the shelf water. Average annual discharge of fresh water is 1285 cu m/sec, enough to replace all the shelf water of the New York Bight in approximately 64 years. However, the salinity of the New York Bight water is maintained for the most part between 30 to 33 parts per thousand, indicating an influx of saltier oceanic water which mixes with the river water. River water must on an average be diluted by ten parts of ocean water to produce typical shelf water. (See also W71-13624) (Knapp-USGS)
W71-13626

COASTAL-ZONE GEOLOGY AND ITS RELATIONSHIP TO WATER POLLUTION PROBLEMS,
Barnard Coll., New York. Dept. of Geology and Geography.
J. E. Sanders.
In: Water Pollution in the Greater New York Area - Symposium, Gordon and Breach, New York, N.Y., p 23-36, 1970. 3 fig, 17 ref.

Descriptors: *Sedimentation, *Path of pollutants, *Beaches, *Coasts, Hydrogeology, New York, Paleohydrology, Beach erosion, Sediment transport, Stratigraphy, Sediments, Bottom sediments, Water pollution sources.
Identifiers: *New York Bight.

Coastal-zone geology relates to water-pollution problems through various aspects of sedimentology. The sediments and waters interact chemically both while the sediments are being transported and after they come to rest on the bottom. Today's coastal sediments of the New York metropolitan area reflect late cenozoic geologic history. Great oscillations of climate and profound changes of sea level occurred and left their imprint on the morphology and surficial sediments. Along exposed coasts waves shift sandy sediments laterally. Rockaway spit, which is building into Jamaica Bay, and Sandy Hook spit, which is growing into Raritan Bay, have been mapped for more than a century. Accordingly, lateral position along the spit can be used to date the time when former bay-bottom sediments became buried by sand. In these buried bay-bottom sediments may be a record of the introduction of various pollutants into New York harbor. The vertical accretion of tidal marshes, equalling the 1-mm/yr rate of regional subsidence, is storing vast tonnages of fine particles shifted by the tides landward from suspension in the open waters of the New York Bight. (See also W71-13624) (Knapp-USGS)
W71-13627

WATER QUALITY OF THE NEW YORK HARBOR AND BIGHT AREAS,
Environmental Protection Agency, Edison, N.J., Hudson-Delaware Basins Office.
E. T. Smith.
In: Water Pollution in the Greater New York Area - Symposium, Gordon and Breach, New York, N.Y., p 39-52, 1970. 6 fig, 7 ref.

Descriptors: *Water quality, *New York, *Hudson River, *Water pollution control, Sewage treatment, Waste water treatment, Reviews, Water pollution sources, Dissolved oxygen, Biochemical oxygen demand.
Identifiers: *New York City.

Water quality in the New York area is monitored by the federal government and the Interstate Sanitation Commission. The parameters measured include dissolved oxygen, pH, conductivity, and oxidation - reduction potential. The average dissolved oxygen level in New York harbor has remained approximately constant at about 40% of saturation over the last 40 or more years in spite of an increasing load of raw sewage. This is at least partly due to the installation of waste treatment facilities. A plan for the control of water quality in New York Harbor covering the period 1980-2000 is now being developed. This plan is aimed at securing water quality suitable for all of the projected uses of water and takes account of projected variations with time of demographic and economic growth, waste load, cost of treatment and benefits. (See also W71-13624) (Knapp-USGS)
W71-13628

WATER CHEMISTRY OF THE LOWER HUDSON RIVER.
New York Univ., Medical Center, N.Y. Lab. for Environmental Studies.

In: Water Pollution in the Greater New York Area - Symposium, Gordon and Breach, New York, N.Y., p 53-73, 1970. 3 fig, 7 tab, 9 ref.

Descriptors: *Water chemistry, *Water quality, *Hudson River, *New York, Trace elements, Radioisotopes, Pesticides, Ecology, Water pollution effects, Water pollution sources, Water pollution control.
Identifiers: *New York City.

Studies of the general water chemistry, trace elements, radionuclides, and pesticide residues in the lower Hudson River during the past six years indicate that the river is not now grossly degraded by pollution, except possibly in localized areas. However, nutrient levels are high enough to cause concern about impending excessive algal growths; the dissolved oxygen in the hot summer months is approaching the minimum for sensitive biota; trace metals are now present at sufficient levels to cause concern about possible toxic effects; pesticide residue accumulations in some fish and birds cause concern for the health of these organisms; but radionuclide levels are far below concentrations considered to be harmful to aquatic biota or man. Clearly, the ecology of the river is approaching problem status on several bases. Many of these problems are of such nature that their solution can be realistically sought only through coordinated multi- disciplinary efforts. (See also W71-13624) (Knapp-USGS)
W71-13629

WATER QUALITY ANALYSIS FOR THE NEW YORK HARBOR COMPLEX,
Manhattan Coll., Bronx, N.Y. Dept. of Civil Engineering.
D. J. O'Connor.
In: Water Pollution in the Greater New York Area - Symposium, Gordon and Breach, New York, N.Y., p 121-144, 1970. 12 fig, 2 tab, 1 ref.

Descriptors: *Mathematical models, *Hudson River, *New York, *Water pollution effects, *Path of pollutants, Water pollution control, Forecasting, Streamflow, Tides, Estuaries, Hydraulics, Saline water intrusion.
Identifiers: *New York Harbor.

A mathematical model of the New York Harbor complex includes the geomorphological hydraulic, and tidal factors of the waterways, and the physical, chemical, and biological characteristics of the waste-waters. A comparison of results obtained using the model with measurements recorded over the past few decades shows that the calculations and measurements agree quite well. The verified model has been used to predict the effects on water quality of proposed new water treatment facilities. The effect of fresh water flow from the Hudson River does not appear to be significant during the summer and early fall seasons, at least with respect to the concentration of dissolved oxygen and oxygen-demanding material. The influence of a single treatment facility on water quality is relatively small and may be obscured by the variability of other factors. The improvement in water quality is apparent when the combined effect of a number of

facilities is considered. (See also W71-13624) (Knapp-USGS)
W71-13630

WATER QUALITY SURVEILLANCE IN NEW YORK STATE,
New York State Dept. of Health, Albany. Div. of Pure Water.
R. E. Maylath.
In: Water Pollution in the Greater New York Area - Symposium, Gordon and Breach, New York, N.Y., p 157-170, 1970. 2 fig, 2 tab.

Descriptors: *Monitoring, *Water quality, *New York, *Data collections, Water pollution control, Regulation, Water quality control, Sampling, Water analysis, Data processing.

New York State's Water Quality Surveillance Program has 114 measurement stations spread throughout the state. The information obtained from these stations can be used by the State Water Pollution Control Agency to establish standards and monitor water quality. The sampling frequency is such that about 30 samples per week are obtained for analysis. Data processing and computer techniques are being used in handling the extensive results now being obtained. (See also W71-13624) (Knapp-USGS)
W71-13631

HAVEMAN V BEULOW (POLLUTION OF WATERWELL).
For primary bibliographic entry see Field 06E.
W71-13645

ECONOMIC AND ENGINEERING ASPECTS OF WATER IN DELAWARE'S AGRI-BUSINESS INDUSTRY,
Delaware Univ., Newark. Dept. of Agricultural Economics.
Raymond C. Smith.
Available from the National Technical Information Service as PB-203 738, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Delaware Water Resources Center, Newark, December, 1970. 7 p, 2 ref. OWRR B-003-DEL (1).

Descriptors: Water pollutant sources, Water quality, Delaware, Effluents, *Biochemical oxygen demand, *Chemical oxygen demand, Industrial wastes, *Farm wastes, Reclaimed water, Water reuse.
Identifiers: *Processing wastes, *Poultry wastes.

Data on processes that contribute to wastewater pollution were obtained from five of the six poultry processing plants in Delaware. BOD, COD, and suspended solids tests were run on samples of wastewater from various locations within the plants. Only one plant had facilities for recirculation of water and this was not in operation during the study. Main effluent volume of the plants studied ranged from one-fourth to one-half million gallons per day. A regression analysis of COD and BOD in poultry processing wastewater indicated a fairly good approximation of BOD values can be estimated from COD values. For the various plants, BOD values averaged between .9 and 2.3 lbs./1,000 birds for the scalding operation, between .2 and 7.8 lbs./1,000 birds for the dressing operation, .4 to 13.4 lbs./1,000 birds for the eviscerating operation, and .4 to 4.6 lbs./1,000 birds for the chilling operation. Per unit volumes of main effluent varied considerably among plants. Two plants discharged over twice as much wastewater per 1,000 birds as the two lowest plants, and these plants also had the highest per unit values for BOD and suspended solids. The lowest plant produced 3.2 gallons or wastewater per processed bird compared to 8.2 gallons for the highest plant. It appears that most poultry processing plants could reduce the volume and strength of their wastewater. The possibility of recirculation of wastewater for certain operations should be explored.
W71-13658

ENVIRONMENTAL CONSERVATION: THE OIL AND GAS INDUSTRIES, VOLUME ONE.
National Petroleum Council, Washington, D.C.

1971. 106 p, 5 fig, 6 photo, 18 tab, 89 ref, 3 append.

Descriptors: *Oil industry, *Environmental effects, *Natural gas, *Water pollution sources, Pollutants, Conservation, Oil, Exploration, Gasoline, Fuels, Oil wastes, Water pollution, Industrial production, Marketing, Operations, Legal aspects, Transportation, Economics, Regulation, Air pollution, Storage, Evaluation.

Responding to a request from the Department of the Interior, the National Petroleum Council prepared this report on the oil and gas industries' relationship to environmental conservation. With respect to the environmental effects of industry operations, the report specifically considers the following factors: (1) fundamentals of industry operations; (2) exploration and production; (3) refining; (4) storage, transportation, and marketing; and (5) oil spills. The report analyzes the environmental effects of oil and gas product utilization. The problem of emissions from mobile and off-highway equipment and stationary plants is considered. General comments and conclusions are advanced on: (1) the role of law and regulatory policy, (2) the economics of environmental conservation, (3) the requirements for conservation, (4) balancing basic needs, and (5) the need for effective cooperation. (Gallagher-Florida)
W71-13661

REPORT OF THE FAO TECHNICAL CONFERENCE ON MARINE POLLUTION AND ITS EFFECTS ON LIVING RESOURCES AND FISHING.
Food and Agriculture Organization (UN), New York. Fishery Resources Div.
For primary bibliographic entry see Field 05C.
W71-13723

EVALUATION OF WASTE DISPERSION IN ESTUARIES USING FLUORESCENT TRACER DYE,
Raytheon Environmental Research Lab., New London, Conn.
S. G. Chamberlain and D. O. Cook.
In: Marine Technology Society 7th Annual Conference, August 16-18, 1971, Washington, D.C., p639-646. 3 fig, 5 ref.

Descriptors: *Estuaries, *Effluents, *Tracers, *Dye releases, *Dispersion, Water pollution sources, Fluorescence, Mathematical models, Data collections, Surveys, On-Site investigations, Sewage, Chemical wastes, Path of pollutants.
Identifiers: *Waste dispersion, Fluorescent tracer dye, Thermal wastes.

Fluorescent tracer dye techniques have been used to analyze problems associated with disposal of sewage, chemical, and thermal wastes. The design of the field experiment, dye characteristics, instrumentation, logistics, and data reduction required to perform a survey are presented. In order to relate the experiment to an actual effluent and predict its behavior under various oceanographic conditions, a mathematical analysis of the data is performed. Categories of effluent dispersion mathematical models and the need to choose an appropriate model are discussed. A general procedure for using the models to analyze and extrapolate the dye data is described. (Currer-PAI)
W71-13738

OIL SPILL RECONNAISSANCE USING REMOTE-SENSING TECHNIQUES,
Texas Instruments, Inc., Dallas, Tex.
S. A. Terry, F. J. Buckmeier, and J. A. Watson.
In: Marine Technology Society 7th Annual Conference, August 16-18, 1971, Washington, D.C., p 647-662. 16 fig, 3 ref.

Descriptors: *Oil-water interfaces, *Remote sensing, *Infrared radiation, Oil industry, Water pollution sources, Ocean circulation, Data collections, Currents (Water), Gulf of Mexico, Path of pollutants.
Identifiers: *Oil spill reconnaissance.

Remote-sensing techniques to provide immediate information regarding the areal extent and direction of spreading of oil spills are described. The information gathered through utilization of the techniques described, along with data on oceanographic and meteorologic variables, permits quick decisions necessary to combat the spill. Examples are shown from survey data collected at the site of an oil spill in the gulf of Mexico. (Currer-PAI)
W71-13739

EVALUATION OF ESTUARINE CIRCULATION BY AERIAL PHOTOGRAPHY OF CURRENT DROGUES,
Raytheon Environmental Research Lab., New London, Conn.
D. O. Cook.
In: Marine Technology Society 7th Annual Conference, August 16-18, 1971, Washington, D.C., p 663-670. 7 fig, 7 ref.

Descriptors: *Estuaries, *Drift bottles, *Aerial photography, *Hydrologic data, Current meters, Surveys, Effluents, Water circulation, Land use, Path of pollutants, Water pollution sources.
Identifiers: *Current drogues, *Time-lapse photography, Estuary circulation.

Time-lapse photography of current drogues is being used in evaluations of estuary circulation. The drogue consists of a metal vane suspended by an adjusted line from a flat styrofoam float encased in fiberglass. Drogue migration is monitored by aerial photography of the site at intervals of 15-25 minutes for a 6-8 hour period. Migration data is transcribed from photographic negatives to a base map. The drogue studies are directed towards the practical problem of improving effluent release systems. (Currer-PAI)
W71-13740

CONTAINER DUMPING IN THE NORTH SEA,
United Nations Educational, Scientific and Cultural Organization, Paris (France). Intergovernmental Oceanographic Commission.
S. B. Saila.
Marine Pollution Bulletin, Vol 2, No 8, p 125-127, August 1971. 19 ref.

Descriptors: *Chemical wastes, *Waste disposal, *Ocean currents, Movement, Radioactive wastes, Water pollution sources.
Identifiers: *Ocean dumping, Container dumping, North Sea, Containerized waste recovery, Wave-induced particle velocity.

An account is given of the factors involved in the movement of containers filled with toxic chemicals which have been dumped in the North Sea and accidentally recovered in trawler nets. It seems to be the combined effect of the steady current and the wave-induced particle velocity in the shallow water of the North Sea that is responsible for their movement from the dumping sites. (Currer-PAI)
W71-13748

TWO-DIMENSIONAL WIND SETUP OF OIL ON WATER,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
R. M. Sorenson and E. B. Spenser.
Journal of the Waterways, Harbors, and Coastal Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 97, No WW3, p 517-530, August 1971.

Descriptors: *Oil-water interfaces, *Wind tides, Flumes, Flow rates, Wind velocity, Forecasting, Water pollution sources, Water pollution control.

Identifiers: *Oil setup, *Oil setdown, Oil properties, Oilspill containment systems, Wind-wave flume.

An analytic and experimental study made to predict the two-dimensional setup and setdown of oil of specific density and viscosity subjected to a wind stress acting over a given fetch, is presented. An analytical expression for oil depth as a function of oil properties, wind velocity and fetch was developed and verified in a two-dimensional flume. The study was part of an overall research project to develop an oil spill containment system. (Currer-PAI)
W71-13749

COASTAL WATER POLLUTION, POLLUTION OF THE SEA BY OIL SPILLS.
North Atlantic Treaty Organization, Brussels (Belgium).
For primary bibliographic entry see Field 05G.
W71-13751

REPORT OF OIL SPILLAGE TRIAL - JUNE 1970,
Royal Naval Scientific Service, London (England).
For primary bibliographic entry see Field 05G.
W71-13758

AGRICULTURAL LAND DRAINAGE AND STREAM POLLUTION,
John M. Henderson.
Proceedings of the American Society of Civil Engineers, SA6, Vol 88, November 1962. 4 tab, 11 ref, p 61-75.

Descriptors: *Water pollution sources, *Biochemical oxygen demand, *Drainage effects, Public health, Waste water treatment, Zoonoses, *Farm wastes, Waste identification, Diseases, Runoff, Chemical properties, Physical properties.
Identifiers: *Human disease hazards, Organic pollution, Health hazards, Waste characteristics, Water-borne diseases, Population equivalents.

The inherent characteristics of organic pollution contributed to agricultural land drainage by farm animals are investigated as well as whether this contribution can be a significant problem in stream pollution. The nature of abatement measures is outlined, together with their practicability and effectiveness. Human diseases hazards in water-borne animal wastes are reviewed. (Christenbury-Iowa State)
W71-13786

RELEASE OF HERBICIDES FROM CLAY MINERALS AS A FUNCTION OF WATER CONTENT: I. Kaolinite,
North Carolina State Univ., Raleigh. Agricultural Experiment Station.
H. Don Scott, and J. F. Lutz.
Soil Science Society of America Proceedings, Vol 35, No 3, p 374-379, May-June 1971. 6 p, 1 fig, 1 tab, 19 ref. OWRR Project A-008-NC (5).

Descriptors: *Herbicides, *Adsorption, *Clay minerals, *Pesticide residues, *Moisture content, Kaolinite, Path of pollutants, Soil chemical properties, Soil contamination, Agricultural chemicals, Soil water, Soil water movement, Clays.
Identifiers: *Herbicide residues (Soils).

The influence of water content on the release of six herbicides from kaolinite was studied. Kaolinite suspensions were treated with herbicides labeled with C-14 at rates of 1 and 4 micrograms/gram (based on dry weight of clay). Extracts of the soil solution were obtained at successively increased increments of pressure from 0.3 to 15 bars, using the pressure membrane extractor. For all herbicides used, except simazine, the concentration in the extracts decreased with increasing pressure increments. The decreases were greatest with diuron and chlorpropham. Simazine concentration was from two to three times greater in the high than in the low-pressure extracts. High concentrations in low-pressure extracts suggest that plant availability is high and that movement with water could be a problem with high rainfall under field conditions. Fluometuron and 2,4-D were negatively adsorbed; the others were positively adsorbed. The order of release in terms of total recovery of herbicide applies at the 1-ppm rate was: fluometuron, 2,4-D, atrazine, chlorpropham, simazine, diuron. (Knapp-USGS)
W71-13797

EFFECT OF SELECTED FACTORS ON PESTICIDE SORPTION AND DESORPTION IN THE AQUATIC SYSTEM,
Missouri Univ., Rolla. Dept. of Civil Engineering.
J. C. Huang.
Water Pollution Control Federation Journal, Vol 43, No 8, p 1739-1748, August 1971. 8 fig, 19 ref. OWRR A-016-MO (13) B-037-MO (1).

Descriptors: *Path of pollutants, *Pesticide residues, *Adsorption, *Chlorinated hydrocarbon pesticides, Equilibrium, Clay minerals, Water chemistry, Water temperature, Hydrogen ion concentration, Salinity, Clays, Dieldrin, Sorption.

The effect of pH, temperature, salt (NaCl) concentration, and several representative organic pollutants on the sorption and desorption of chlorinated hydrocarbon pesticides by aquatic clay sediment was investigated. The experimental approach included an open-system aquatic model study and the closed-system batch study. The aquatic model systems were used to investigate the effect of pH, temperature, and salt concentration of water on the uptake and release of dieldrin by a benthic layer of montmorillonite clay. The batch technique was used to evaluate the effect of glucose, alanine, stearic acid, and filtered wastewater on the pesticide adsorption rate and equilibrium. None of these selected factors seem to exert any significant influence on pesticide uptake and release by the aquatic sediment. (Knapp-USGS)
W71-13800

POMME DE TERRE LAKE BACTERIOLOGICAL STUDY (MISSOURI),
Environmental Protection Agency, Kansas City, Mo.
Thomas O. Dahl.
14 p, 5 tab, 2 fig.

Descriptors: Coliforms, Aquatic bacteria, Water pollution, Lakes, Recreation, Missouri.
Identifiers: Pomme De Terre Lake (Missouri), Water quality standards, Osage river.

Bacteriological investigation of Pomme de Terre Lake in southern Missouri designed to (1) correlate fecal coliform bacteria group levels with recreational usage of facilities and (2) determine compliance with State Water Quality Standards. Bacteriological indicator analyses included total and fecal coliforms and a limited number of fecal streptococci. Report documents continued high quality waters from fecal coliform bacteria standpoint, despite drastic increase in recreational use of lake. (Dahl-EPA)
W71-13814

EFFECT OF LOW pH ON THE SURVIVAL AND EMERGENCE OF AQUATIC INSECTS,
Environmental Protection Agency, Duluth, Minn. National Water Quality Lab.
Henry L. Bell.
Water Research, Vol. 5, p 313-319, 1971. 2 tab, 2 fig, 13 ref.

Descriptors: *Aquatic insects, *Mortality, Dragonflies, *Lethal limits, *Hydrogen ion concentration, Stoneflies, Caddisflies, Mayflies, *Toxicity, Bioassay, Indicators, Lethal limit.

Mature larvae and nymphs of 9 species of aquatic insects (Dragonflies, stoneflies, caddisflies, and mayfly) were tested in the laboratory at pH values from 1.0 to 7.0 The TL50 values (pH at which 50 per cent of the organisms died) at 30 days ranged from pH 2.45 (Brachycentrus americanus) to pH 5.38 (Ephemerella subvaria). The range at which 50 per cent of the insects emerged was 4.0-5.9. The 9 species tested were all more sensitive to low pH during the period of emergence. (Bell-EPA)
W71-13815

THE CASE FOR BETTER WASTE TREATMENT,
Environmental Protection Agency, Kansas City, Mo.
For primary bibliographic entry see Field 05D.
W71-13818

POLLUTION EVALUATION SURVEY OF THE INTERSTATE WATERS OF THE RED RIVER OF THE NORTH (SEPTEMBER 1969-APRIL 1970).
Federal Water Quality Administration, Kansas City, Mo. Missouri Basin Region.

Report, June 1970, 142 p, 17 fig, 27 tab.

Descriptors: *Water pollution sources, *Water pollution effects, Municipal wastes, Water injury, Oxygen sag, Sewage effluents, North Dakota, Minnesota, Impaired water quality, Industrial wastes.
Identifiers: Fargo (North Dakota), Moorhead (Minnesota), American Crystal Sugar Company, Red River of the North, Grand Forks (North Dakota).

The report summarizes the survey data obtained form the September, 1969 to April, 1970 investigation of the water quality of the Red River of the North. The River basin and study area are described and a brief background of other surveys and water quality enforcement actions is given. Pollution sources are identified and relative contributions from each source are determined. River water quality is described and violations of water quality standards are listed. Recommendations are given to eliminate future violations of water quality standards. (Hegg-EPA)
W71-13819

EVERYONE CAN'T LIVE UPSTREAM: A CONTEMPORARY HISTORY OF THE WATER QUALITY PROBLEMS ON THE MISSOURI RIVER- (SIOUX CITY, IOWA TO HERMANN, MISSOURI),
Environmental Protection Agency, Kansas City, Mo.
For primary bibliographic entry see Field 05D.
W71-13821

STOCHASTIC MODELING FOR WATER QUALITY MANAGEMENT.
Stochastics, Inc., Blacksburg, Va.

Copy available from GPO Sup Doc for $3.00; microfiche from NTIS as PB-203 427, $0.95. Environmental Protection Agency, Water Pollution Control Research Series, February 1971. 395 p, 40 fig, 29 tab, 77 ref, 3 append. EPA Program 16090 DUH 02/71. Contract 14-12-849.

Descriptors: *Stochastic processes, *Simulation analysis, *Statistical model, *Water pollution, *Estuaries, *Streams, *Variability, Biochemical oxygen demand, Dissolved oxygen, Approximation method, Water quality, Ohio River.
Identifiers: *Stochastic models, Segmented model, Random inputs, Potomac, Poisson.

Because water pollution is a stochastic process, water quality standards must incorporate variability. After reviewing previous deterministic models, this document generalized and extended earlier stochastic models. In particular, the project ex-

panded and verified the Custer and Krutchkoff model. The specific objectives were to (a) adapt the model to accept variable or random input loadings; (b) to adapt the estuary model to treat segmented estuaries; (c) to verify the adapted models with data supplied by WQO; (d) to find a method for using data to estimate and predict the stochastic parameter. The objectives were successfully achieved and verification accomplished with data from the Ohio River and the Potomac Estuary. The report concluded that the extended Stochastic Model can handle load inputs, rate constants, velocity, temperature, benthal demands, land runoff, hydraulic parameters, geometry, and random pollution inputs. It can accurately predict the time-dependent mean concentration in a transient state condition or pseudo-study state condition at any point in a stream or estuary. Further, the proportion of time that the BOD, DO and nitrogen concentrations will be above or below any given level can also be predicted accurately. Recommendations were made for further use and expansion of the model.
W71-13824

MIXING PROCESSES IN GREEN BAY,
Wisconsin Univ., Madison. Marine Studies Center.
For primary bibliographic entry see Field 02H.
W71-13828

SALT MEASUREMENT ON THE COAST OF BARBADOS, WEST INDIES,
McGill Univ., Montreal (Quebec).
R. E. Randall.
Oikos, Vol 21, No 1, p 65-70, 1970. 4 fig, 2 tab, 16 ref.

Descriptors: *Salts, *Coasts, *Winds, *Aerosols, Dusts, Path of pollutants, Salinity, Silts, Clays, Weather, Sediment transport, Topography.
Identifiers: Barbados.

Examination of ecological literature shows little evidence of the measurement of the distribution of airborne salt particles on coasts. This factor was investigated in Barbados in 1967. Quantities of salt were measured in the air, at ground surface, and within the soil at various distances from the sea. Samples were collected from 15 locations during a range of weather conditions. The results show a regular decrease in salinity with increasing distance from the sea. Quantities of salt in the soil have a direct relationship to silt and clay content. For any soil-type salt concentrations are higher on the Windward coast. There is a close relationship between changes in aerial and surface salt deposition and windspeed on the Windward coast. The average quantities of salt deposited at the ground surface range from 1/6 air salinity in exposed situations to 2/3 air salinity on the Leeward coast. Relief is an important factor in ground surface salt deposition through its effects on the lower strata of the air. (Knapp-USGS)
W71-13831

PROBABILISTIC ANALYSIS OF DISSOLVED OXYGEN,
Colorado State Univ., Fort Collins, Dept. of Civil Engineering.
For primary bibliographic entry see Field 05A.
W71-13852

STUDY OF SULFUR RECOVERY FROM COAL REFUSE,
Black, Sivalls and Bryson, Inc., Pittsburgh, Pa. Applied Technology Div.
For primary bibliographic entry see Field 05G.
W71-13895

CRAWFORD V YEATTS (SALT WATER POLLUTION OF FARMLANDS FROM OIL DRILLING OPERATIONS).
For primary bibliographic entry see Field 06E.
W71-13899

EFFECTS OF PLACER MINING ON WATER QUALITY IN ALASKA.
Federal Water Pollution Control Administration, College, Alaska, Alaska Water Lab.

Report, Feb. 1969, 83 p, 13 fig, 18 tab, 3 ref.

Descriptors: *Alluvium, *Silts, *Placer mining, *Loess, *Turbidity, *Dissolved oxygen, *Water pollution effects, Water pollution sources, Silting, Hydraulic mining, Sluices, Mining, Aquatic environment, Alaska, Water quality, Stream fisheries, Fish food organisms, Fish diseases, Fish populations.
Identifiers: Hydraulic stripping, Hydraulic giant, Gold mining.

Water of excellent quality was found in most Central Alaska streams above mining operations. Good populations of fish and of fish food organisms were found in the clear waters above mining operations, and were absent or greatly reduced in the turbid, silty waters below mines. Mining operations produce physical and water quality conditions that inhibit upstream migration of fish. The termination of mining operations does not always eliminate water quality degradation. Lists of the major faunal groups in water of different quality are given. (Katz-Washington)
W71-13955

HOW MANY INDIVIDUAL WELLS ARE CONTAMINATED.
Ground Water Resources Inst., Chicago, Ill.

Ground Water Resources Institute Quarterly, Vol 2, No 1, p 11-12, Spring 1969.

Descriptors: *Water wells, *Drilling, *Waste disposal systems, Water pollution sources, Water quality control.
Identifiers: *Water quality tests, New wells, Reopened wells, Suspected wells, Public health agencies, Private laboratories, Well construction methods.

A Ground Water Resources Institute survey was made covering 1,500 county sanitarians throughout the country. 345 survey questionnaires were returned, giving a response of 23 percent. The results show that (1) the 345 counties reported represent 21.9 million people, or slightly over 10% of the national population; (2) 5.5 million families reside in the counties reporting, of which 3.7 million are served by central water and 1.8 million by private wells; (3) Nearly all private well owners are served by private sewage disposal systems. The survey shows that a small percentage of the counties reporting requires water quality tests. Only 21.1% require such tests on new wells, 13.6% on wells opened for redrilling or pump maintenance and only 34.2% for wells suspected of contamination. The public health officials, as surveyed, most frequently listed improper well construction as a major cause of well contamination, followed by sewage disposal fields located too near the well, insufficient well depth and use of dug wells, etc. The G.W.R.I. survey shows that the extent of well contamination has been grossly overstated, although a problem, and that mandatory well sample testing is needed to isolate the problem wells and protect public health, and that sound well-pump legislation is needed to control well construction methods and misuse of private disposal systems. (Campbell-NWWA)
W71-13967

WATER QUALITY SIMULATION MODEL,
Camp, Dresser and McKee, Boston, Mass.
G. R. Grantham, J. C. Schaake, Jr., and E. E. Pyatt.
Journal of the Sanitary Engineering Division, ASCE, Vol 97, No SA5, p 569-585, October 1971. 22 ref, 2 append.

Descriptors: *Computer models, *Simulation analysis, *Synthetic hydrology, *Dissolved oxygen, *Water quality, *River systems, Stochastic processes, Reservoir operation, Stream gages.
Identifiers: *Farmington River Basin, Streeter-Phelps.

A simulation model was described which simulated surface water hydrology of a watershed having a dentritic drainage pattern and the dissolved oxygen (DO) balance in streams in the watershed. The model was used to study the economic benefits of low-flow augmentation versus increased degree of wastewater treatment, for water quality control. The model generated weekly (48 time intervals per year) streamflow and water quality data using inputs of stream gage records, reservoir regulation, water uses, wastewater discharges and other vital parapetric data. The model was tested on the Farmington River Basin, Connecticut. Mathematical formulas expressed all pertinent relationships and autoregressive stochastic processes represented the random behavior of hydrologic phenomena. The computer used was the IBM 360/50. Application of the model was successful and the hydrologic simulations compared reasonably with recorded data. (Markell-Cornell)
W71-13978

WATER QUALITY MANAGEMENT METHODOLOGY AND ITS APPLICATION TO THE SAINT JOHN RIVER, (Appendix H).
Department of Environment, Ottawa (Ontario). Directorate of Policy Planning.

H. G. Acres Limited, Niagara Falls, Ontario, p 1-76, August 1971. 15 flowcharts.

Descriptors: *Optimum development plans, *Linear programming, *Water quality control, *River system, *Dissolved oxygen, *Biochemical oxygen demand, *Cost-benefit analysis, Economic justification, River basin development, Water pollution sources.
Identifiers: *St. John River.

The study's objective was the optimization of the assimilative capacity of a river system in order to achieve a minimum treatment cost and/or a maximum social utility objective by using dissolved oxygen (DO) concentrations as a surrogate utility. Linear equality and inequality constraints were used. The constraint equations stated that DO and BOD concentrations at specific points could not fall below certain prescribed values (DO and BOD standards); that treatment plants for each effluent must equal unity and that the budget constraints on individual treatment plants or on portions of the system must exceed or be less than prescribed amounts. In the first phase of the screening model, the data describing the geometry of the river basin, its hydrology, effluent locations and quantities, treatment plant-cost removal relationships and desired quality standards were converted into coefficients for a linear program referred to as the Coefficient Program. The second phase of the model was the linear programming solution. The MPS/360 computer was used. It was concluded that in actual practice greater emphasis will be placed on lowering the DO standards throughout and performing parametric variation on the budget constraint as an aid in setting the DO standards. (See also W71-13981) (Markell-Cornell)
W71-13980

WATER QUALITY MODELS, (Appendix A).
Department of Environment, Ottawa (Ontario). Directorate of Policy Planning.

H. G. Acres Limited, Niagara Falls, Ontario, p 1-53, August 1971. 70 fig, 1 tab, 51 ref.

Descriptors: *Optimization, *Simulation analysis, *Stochastic processes, *Computer models, *Sequential analysis, *Synthetic hydrology, *Water quality control, *Dissolved oxygen, *Biochemical oxygen demand, Pollutants, Estuaries, Cost-benefit analysis, Streamflow.
Identifiers: *St. John River Basin.

This study selected and developed an optimization model and a time-varying simulation model for water quality planning and management in Canada. The St. John River Basin was used to test the models and demonstrate their use for resource planning. The pollutants used were dissolved oxygen (DO) and biochemical oxygen demand (BOD). The model was deterministic and the water quality analyses were based on a steady-state stream flow regime and waste input pattern. The means to handle treatment cost data and political and institutional constraints were discussed. The model used the MPS/360 programming package. A non-linear formulation of the programming model was presented. Both models were used to obtain an initial first estimate of effluent charges. The simulation model discussed, calculated, and evaluated the time-varying water quality levels at all quality points, for a number of pollutants. Extension of the models for use to estuaries was discussed since the chemical and diffusion behavior of the estuary BOD-DO system is insufficiently understood and existing models which predict hydrodynamic behavior cannot be used without significant calibration. (See also W71-13980) (Markell-Cornell)
W71-13981

RURAL SOURCES OF NITRATES IN WATER,
Wisconsin Univ., Madison. Dept. of Soils.
R. F. Hensler, and O. J. Attoe.
Available from Engineering Publications Office, 112 Engineering Hall, University of Illinois, Urbana 61801 - Price $4.50. In: Proceedings 12th Sanitary Engineering Conference on Nitrate and Water Supply: Source and Control, February 11-12, 1970, University of Illinois, Urbana: Illinois University, College of Engineering Publication, p 86-98, 1970. 13 p, 4 fig, 3 tab, 26 ref.

Descriptors: *Water pollution sources, *Nitrates, *Farm wastes, Runoff, Fertilizers, Confinement pens, Organic wastes, Septic tanks, Waste disposal, Eutrophication.
Identifiers: *Rural pollution sources.

A review of literature indicates that the contribution of nitrates to surface runoff from rural sources is usually quite low, and ranges from an annual average of about one lb per acre for sod crops and crop rotations, to about six lbs per acre under fallow conditions. Losses of soil material and total nitrogen are directly related to runoff. Total nitrogen losses in the runoff from manure spread on frozen, snow-covered fields are related to snow depth, depth of frost penetration, rate of snow melt, and rains while the soil was still frozen. Total amounts of nitrates in the soil profile are directly related to the rate of nitrogen application and frequency of the fertilized crop in the rotation. Relatively high nitrate content is found in soil profiles taken from barnyards, feedlots, and seepage areas associated with them. In most cases, high nitrate wells are located near barnyards, feedlots, or animal housing units, and in areas of shallow, coarse-textured soils. (Knapp-USGS)
W71-13982

DYNAMICS OF NUTRIENT CONCENTRATIONS IN THE ILLINOIS RIVER,
Illinois State Water Survey, Peoria. Water Quality Section.
Ralph L. Evans, and Wun-cheng Wang.
Available from Engineering Publications Office, 112 Engineering Hall, University of Illinois, Urbana 61801-price $4.50. In: Proceedings 12th Sanitary Engineering Conference on Nitrate and Water Supply: Source and Control, February 11-12, 1970, University of Illinois, Urbana: Illinois University, College of Engineering Publication, p 99-109, 1970. 11 p, 6 fig, 2 tab, 14 ref.

Descriptors: *Water pollution sources, *Illinois, *Nutrients, *Nitrates, *Phosphates, Fluorides, Path of pollutants, Surveys, Sampling, Industrial wastes, Farm wastes, Domestic wastes, Streamflow, Runoff.
Identifiers: *Illinois River, *Peoria Lake.

During a 30 week study of Peoria Lake, an unusually wide reach of the Illinois River, 225 water samples were taken from a 1 meter depth at weekly intervals. The mineral constituents to be evaluated were fluoride, nitrate, organic N, ammonia, and orthophosphate. Fluoride concentration was used as the reference source for defining the effect of stream flow on the mineral concentrations. Fluoride and orthophosphate concentrations decreased as flow increased, the ratio of orthophosphate to fluoride remained constant regardless of flow, and the ratios of nitrate/fluoride and organic N/fluoride increased as flow increased. The concentration - flow patterns support the hypothesis that a major source of nitrogen is derived from surface runoff, whereas phosphorus from runoff is minimal. (Knapp-USGS)
W71-13983

AIR POLLUTION ASPECTS OF ODOROUS COMPOUNDS,
Litton Systems, Inc., Bethesda, Md. Environmental Systems Div.
For primary bibliographic entry see Field 05C.
W71-13984

GASES AND ODORS FROM POULTRY MANURE: A SELECTED BIBLIOGRAPHY,
Merck and Co., Rahway, N.J. Quinton Research Labs.
W. E. Burnett.
Poultry Science, Vol 50, No 1, p 61-63, January 1971. 35 ref.

Descriptors: *Poultry, *Odor, *Gases, *Farm wastes, *Bibliographies, Research and development, Management.

This is a bibliography of 35 articles pertaining to gases and odors from poultry wastes. The articles are grouped into three divisions: (1) The microbiology and chemistry of gas and odor production; (2) Identification and determination of gases and odors; (3) Odor control methods. (Hazen-Iowa State)
W71-13987

5C. Effects of Pollution

CYCLING OF ZINC-65 BY COLUMBIA RIVER PERIPHYTON IN A CLOSED LOTIC MICROCOSM,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
For primary bibliographic entry see Field 05B.
W71-13102

LIMNOLOGICAL OBSERVATIONS ON LAKE KARIBA DURING 1967 WITH EMPHASIS ON SOME SPECIAL FEATURES,
Lake Kariba Fisheries Research Inst. (Rhodesia).
G. W. Begg.
Limnol Oceanogr. 15 (5): 776-788, Illus, Maps, 1970.
Identifiers: Chemocline, Kariba, Lake, Limnological, Rhodesia, Salvinia-P.

Results of limnological recordings made during 1967 on Lake Kariba are described. Kariba is monomictic, mesotrophic, and has 5 defined basins, each of which exhibits its own individuality. The 2 upstream basins are riverine; they are flushed out in May by the Zambezi River floods and thereby assume turnover characteristics earlier than the other 3 basins, which are truly lacustrine with temperature-induced turnover. Great amplitude of variation in water chemistry exists relating to the basin locality, biotope (river, estuary, cleared area, open water), time of year (turnover winter/summer), and depth. Generally, values of dissolved O2, conductivity, alkalinity, and pH fall from surface to bottom. When H2S is present, alkalinity and conductivity values increase. A chemocline follows the profile of the thermocline. Occasionally density currents occur at depth, particularly after the first seasonal floods. Transparency decreases toward the head of the lake and in all areas decreases after turnover. The source of H2S is the Salvinia-infested rivers. Dissolved O2 in the hypolimnion is depleted 4 to 5 mo. after turnover. The hydrobiological effects of Salvinia are discussed, and the influence of the bottom topography is described.--Copyright 1971, Biological Abstracts, Inc.
W71-13104

ACETYLENE REDUCTION (NITROGEN FIXATION) IN WISCONSIN LAKES,
Department of Agriculture, Fargo, N. Dak. Metabolism Lab.
Donald Rusness, and R. H. Burris.
Limnol Oceanogr. 15 (5): 808-813, Illus, 1970.
Identifiers: Acetylene, Algae, Blue, Fixation, Fluctuation, Green, Lakes, Nitrogen, Phyto, Plankton, Reduction, Seasonal, USA, Wisconsin.

Acetylene reduction was used as an index of the nitrogen-fixing capacity of the phytoplankton of representative oligotrophic and eutrophic lakes in Wisconsin. Acetylene reduction was not measurable in samples from oligotrophic Crystal Lake but was vigorous in samples from eutrophicated lakes. The activity during the season fluctuated widely with the development of blooms of nitrogen-fixing blue-green algae; no activity was demonstrated during winter months. Activity and population generally decreased with depth. Acetylene reduction was low in early morning, rose to a peak at noon, and then declined.--Copyright 1971, Biological Abstracts, Inc.
W71-13105

LIMNOLOGY OF TROPICAL IMPOUNDMENTS: A COMPARATIVE STUDY OF THE MAJOR RESERVOIRS IN MADRAS STATE (INDIA),
Hydrobiological Research Station, Madras (India).
A. Sreenivasan.
Hydrobiologia. 36 (3/4): 443-469, 1970.
Identifiers: Algal, Blooms, Comparative, Dissolved, Fish, Impoundments, India, Limnology, Low, Madras, Oxygen, Pollution, Productivity, Reservoirs, Salts, Tropical.

A limnological study of 17 man-made lakes was made. Thermal features showed absence of stable thermal stratification. Cognizable thermocline did not exist. The South-Western reservoirs with low nutrient and salt content were very poor in productivity, but the high alkaline reservoirs were also not very productive. Some reservoirs with lower alkalinity, hardness and total solids developed algal blooms and were highly productive. Bhavanisagar and Stanley reservoirs with optimal levels of dissolved salts and alkalinity-hardness were fairly productive. Reservoirs with organic soils were better in productivity than those with hgher silica content (Hope Lake, Poondi Reservoir, Vaigai etc.). Dissolved O2 depletion in the bottom was characteristic of productive waters. Total O2 depletion occurred in some of them but in a few depletion was rare and not of great severity. Klinograde curves were characteristic of productive reservoirs. Even when the bottom waters were low in or were devoid of dissolved O2 the outflow from this level picked up O2 within a short distance of 100 m. Effect of water replacement on plankton production is discussed. It is the silt-laden turbid waters that are poor in production. Water releases could be manipulated to assist spawning of fishes and for amelioration of pollution downstream.--Copyright 1971, Biological Abstracts, Inc.
W71-13109

SOME MINERAL NUTRIENT STUDIES OF A LOWLAND MERE IN CHESHIRE, ENGLAND,
Nature Conservancy, Grange-over-Sands (England). Merlewood Research Station.
H. M. Grimshaw, and M. J. Hudson.
Hydrobiologia. 36 (2): 329-341, Illus, 1970.

Identifiers: Algal, Cheshire, England, Growth, Lowland, Mere, Mineral, Nutrient, Patterns, Phyto, Plankton, Seasonal.

Analyses of 9 ionic constituents in Rostherne Mere water were made at regular intervals and 5 depths ove a 2 yr period. Only nitrite-nitrogen showed a regular seasonal pattern. Phosphate-phosphorus and ammonium-nitrogen increased with depth in summer. The results are discussed in relation to the origin of the nutrients, stratification and the phytoplankton of the mere. The levels of nutrients present did not appear to limit algal growth with the possible exception of N.--Copyright 1971, Biological Abstracts, Inc.
W71-13114

THE PHYTOPLANKTON OF THE HUNGARIAN REACH OF THE DANUBE DURING THE WINTER MONTHS (DANUBIALIA HUNGARICA, XLVI.),
Magyar Tudomanyos Akademia, Budapest. station for Danube Research.
G. Szemes.
Ann Univ Sci Budapest Rolando Edetvoes Nominatae Sect Biol. 11: 75-117. Illus. 1969.
Identifiers: Algae, Blue, Danube, Diatoms, Fungi, Green, Hungarian, Phyto, Plankton, Reach, Winter.

The winter microflora composed almost exclusively of bacillariophyceous, schizomycophytic, and mycophytic taxa. This winter material differs from the summer and fall phytoplankton by the very scarce representation of the green and blue-green algae, while members of the divisions Euglenophyta and Pyrrophyta are almost entirely absent. The amount of undecomposed organic detritus was high. The amount of polluting organic substances is less in the upper reaches of the Danube, but considerably higher in the southern sections. Characterization of the collecting sites, and their taxonomic and individuals/10 ml values is discussed. Remarks with respect to some frequently occurring species in the winter phytoplankton are given.--Copyright 1971, Biological Abstracts, Inc.
W71-13130

CHEMICAL EFFECTS OF DECOMPOSING SALMON CARCASSES ON AQUATIC ECOSYSTEMS,
Alaska Univ., College. Inst. of Marine Science.
David C. Brickell and John J. Goering.
Mimeographed report, 1969. 15 p, 7 fig, 3 ref. NSF Grant GB-8636 and Office of Water Research, grant B-015-ALAS (1).

Descriptors: *Salmon, *Decomposing organic matter, *Water pollution sources, *Nitrogen compounds, Water pollution effects, Organic wastes, Water quality, Ammonia, Nitrogen cycle, Crabs, Impaired water quality.
Identifiers: Salmon carcasses, Processing wastes, Seafood processing.

The nitrogen content of a marine bay, Illiuliuk Bay, Alaska (Aleutian Islands) receiving crab processing wastes increased. A drastic increase in the concentration of NH4..-N and a reduction of O2 at stations near the processing plants were observed. After salmon spawned on Baranof Island, their carcasses drifted into the bay and decomposed. This is a natural situation. In the spawning stream Nh4..-N and organic nitrogen increased. Large increases in organic nitrogen compounds were also observed in the estuary. (Katz-Washington)
W71-13142

THE PHYTOPLANKTON OF MINNESOTA LAKES - A PRELIMINARY SURVEY,
Minnesota Univ., Minneapolis. Water Resources Research Inst.
A. J. Brook.
Minnesota Water Resources Research Center, Bulletin 36, June 1971. 12 p, 1 tab, 16 ref. OWRR Project A-007-Minn (2).

Descriptors: *Phytoplankton, *Eutrophication, *Oligotrophy, Minnesota, Lakes, Glacial drift, Nutrients, Salanity, Algae, Diatoms.
Identifiers: *Desmids, *Euplankton, *Limnoplankton.

Between the years 1965 and 1967, phytoplankton collections were taken in the summer from nearly 200 lakes in a diversity of areas throughout the State. About 220 taxa of euplanktonic algae were identified. The analysis of the Minnesota lake phytoplankton indicates there is a diminution in species diversity in the course of the evolutionary progression as lakes change in character from oligotrophy to eutrophy. Many of the markedly eutrophic lakes have suffered severe disturbance of the natural system due to artificial enrichment. Eutrophic lakes in Minnesota are typically dominated in summer and early fall by water blooms of blue green algae as is usual in most productive lakes of temperate regions. Microcystis aeruginosa, M. wesenbergii, Coelosphaerium naegelianium, Alphanizomenon flos aquae, numerous species of Anabaena, Lyngbya birgei, and Gloeotrichia echinulata are most common. (Walton-Minnesota)
W71-13149

PRIMARY AND SECONDARY PRODUCTION IN A LAKE HEATED BY THERMAL POWER PLANT,
Fisheries Research Board of Canada, Winnipeg (Manitoba). Freshwater Inst.
K. Patalas.
'The Environmental Challenge of the 70's.' Proceedings Institute of Environmental Sciences, 16th Annual Technical Meeting, April 12-16, 1970, Boston, Massachusetts, p 267-271, 1970. 7 tab, 17 ref.

Descriptors: *Thermal pollution, *Primary productivity, *Secondary productivity, Productivity, Temperature, Water pollution effects, Crustaceans, Rotifers, Copepods, Daphnia, Biomass, Zooplankton, Phytoplankton, Sampling, Methodology, Herbivores, Carnivores, Eutrophication, Energy transfer.
Identifiers: Lake Lichenskie (Poland), Lake Mikorzynskie (Poland).

The long-term effects of temperature increases on natural plant and animal communities were investigated in the multibasin lake system in central Poland, since thermal effluents heated only one portion of this system. After seven years of thermal power plant operation, a study was made of Lakes Lichenskie and Mikorzynskie, to examine phytoplankton and zooplankton response. Lichenskie's average epilimnic temperature during warmest period was 26 to 28.5C and Mikorzynskie's 21 to 22C. Species were principally the same in both lakes, but the roles played by particular species in the biomass and production differed. Whereas in unheated Mikorzynskie, Mesocyclops and Eudiaptomus played the primary role, in heated Lichenskie, Daphnia, Mesocyclops, Diaphanosoma and Chydorus were the most important producers. Primary production of heated Lake Lichenskie was in the highly eutrophic lake range while the unheated Lake Mikorzynskie showed production typical for the middle range of eutrophic lakes. The zooplankton biomass in both lakes was characteristic for eutrophic lakes. Heating the natural aquatic system to a reasonable degree may not only significantly increase production but also increase efficiency of energy transfer from one trophic level to another. (Jones-Wisconsin)
W71-13171

REVIEW OF NATIONAL RESEARCH POLICY ON EUTROPHICATION PROBLEMS,
Water Pollution Research Lab., Stevenage (England).
A. L. Downing.
Journal of the Society for Water Treatment and Examination, Vol 19, Part 3, p 223-238, 1970. Discussion.

Descriptors: *Eutrophication, *Algal control, Financing, Plant growth, Toxicity, Nutrients, Water quality, Nitrates, Planning, Nitrogen, Phosphorus, Reservoirs, Fisheries, Water supply, Costs, Water demand, Economic justification, Aquatic weed control, Rivers, Agriculture, Rooted aquatic plants, Drainage, Runoff, Fertilizers, Livestock, Economics, Fish kills, Inhibitors, Water pollution sources, Human diseases.
Identifiers: *Research policy, *United Kingdom, *Future trends, Cladophora, Research strategy, Thames River (England), Lee River (England).

For new water supplies and for greater recreational exploitation of natural waters in the United Kingdom, appropriate levels of activity and lines of inquiry are needed. Cost incurred as a result of eutrophication will probably not increase to more than about double the present expenditures by this century's end. If algal and weed growth were fully understood, perhaps some comparatively simple preventive measures could be applied for eliminating these nuisances. A balanced program is required for basic research and for empirical investigations, especially on static waters. Since factors influencing algal growth vary geographically, examining the influences of location of water may show that one method of control may be more appropriate than another. Though it is unlikely elimination of phosphates from detergents would materially reduce algal problems, search for trouble-free substitutes should continue. Processes used in removing nitrogen and phosphorus from effluents should be examined for suitability of removing other substances (carbon adsorption, ozoniation), and ability of effluents to support algal growth by unsuspected components is profoundly important. Growth of weeds in rivers and effect of sewage effluent on Cladophora needs investigation. Insuring that present efforts are well coordinated takes precedence over embarking on many new initiatives. (Jones-Wisconsin)
W71-13172

NUTRIENT BALANCES IN RIVERS,
Water Pollution Research Lab., Stevenage (England).
M. Owens.
Journal of the Society for Water Treatment and Examination, Vol 19, Part 3, p 239-252, 1970. 6 fig, 16 ref, discussion.

Descriptors: *Nitrogen, *Nutrients, *Rivers, Eutrophication, Water pollution sources, Sewage, Effluents, Water pollution effects, Phosphorus, Drainage, Watersheds (Basins), Arable land, Pastures, Surface runoff, Fertilizers, Urbanization.
Identifiers: *United Kingdom, *Nutrient budget, *Great Ouse River (England).

A nutrient budget study of the River Great Ouse (England) was made to assess nutrient proportions derived from agricultural and urban runoff, rainfall, sewage effluents and waste waters. Land drainage, as a major nutrient source was confirmed by determinations from water samples collected from two land drains and the head waters. Compared with other river catchments in England and Wales, except for three heavily industrialized and urban rivers where most nitrogen was derived from sewage effluents, the greater proportion of the nitrogen flow was presumably derived from land drainage, confirming results from the Great Ouse system. The average nitrogen concentration in drainage water from arable land tended to be higher than from permanent pasture; there was some tendency for nitrogen in drainage water to increase with increased application of nitrogenous fertilizers. Although nitrogenous fertilizers have increased substantially, no marked increases of nitrogen loads in rivers at any given flow are apparent. As the catchment becomes urbanized and is compared with actual loads, the hypothetical calculations indicate a greatly increased load of nitrogen discharged to the river. (Jones-Wisconsin)
W71-13173

LOSSES OF NITROGEN AND PHOSPHORUS FROM AGRICULTURAL LAND,
Rothamsted Experimental Station, Harpenden (England).
G. W. Cooke, and R. J. B. Williams.
Journal of the Society for Water Treatment and Examination, Vol 19, Part 3, p 253-276, 1970. 7 tab, 34 ref, discussion.

Descriptors: *Water pollution sources, *Nitrogen, *Nitrates, *Agricultural watersheds, Phosphorus, Leaching, Soils, Drainage, Lysimeters, Fertilizers, Rainfall, Model studies, Analytical techniques, Arable land, Grasslands, Clays, Liquid wastes, Livestock, Solubility, Phosphates, Subsoil, Domestic animals, Erosion, Wind erosion, Suspended load.
Identifiers: *United Kingdom, Plowing, Nitrogen losses.

Nitrogen and phosphorus is introduced to water supplies by leaching of drainage water through agricultural land, by liquid wastes from stockyards and surface runoff from saturated or frozen soil, by movement of fine soil particles down profiles and entering drainage systems, and by erosion of surface soil by wind and water. Drainage from well-farmed arable land in England contains, on the average, 10 mg/l of nitrate-nitrogen. Nitrate loss in drainage from productive land cannot be prevented because more nitrogen will be mineralized from soil reserves and crop residues by microbial action than arable crops can absorb at times. Drainage passing through permeable subsoils to deep water tables carries nitrate that persists in the water. Soluble phosphate fertilizers leach down soil profiles in podzols developed from Bagshot beds which contain only 1-2% clay in the surface while insoluble phosphates are better retained in these topsoils. Phophorus in manure applied in large amounts annually for 20 years penetrated the subsoil of light land at Woburn, the only example of soluble phosphates in arable soils reaching drainage systems. Watercourse contamination may occur where stock are kept on small areas. (Jones-Wisconsin)
W71-13174

TRENDS IN NITRATE CONCENTRATIONS IN ENGLISH RIVERS IN RELATION TO FERTILIZER USE,
Imperial Chemical Industries Ltd., Jealott's Hill (England). Jealott's Hill Research Station.
T. E. Tomlinson.
Journal of the Society for Water Treatment and Examination, Vol 19, Part 3, p 277-293, 1970. 2 fig, 6 tab, 6 ref, discussion.

Descriptors: *Eutrophication, *Nitrates, *Rivers, *Fertilizers, Time, Flow, Drainage, Correlation analysis, Seasonal, Leaching, Water pollution sources, Clovers, Foods, Agriculture, Evaporation, Transpiration, Nitrification, Grasslands.
Identifiers: *United Kingdom.

Origin of nitrate in rivers and factors influencing drainage of nitrate from agricultural land are discussed. A possible correlation between river nitrate levels and nitrogenous fertilizers is examined. 'Annual mean nitrate concentrations' for 1953-1967 in 17 English rivers are presented. These data outline the rivers' behaviour over a long time and were subjected to conventional statistical analysis to assess the correlations of the concentrations with time. Nitrate concentrations did not generally increase. Both assessments of the situations--direct measurement and time distribution of nitrate removal--support the hypothesis that the nitrate originates from land drainage. Although sewage may make greater contribution in some rivers, soil nutrients make the major contribution. Lack of close correlation of nitrate contents of rivers from nitrogen fertilizer usage lies in the oversimplification that fertilizer nitrogen, not recovered by crops, is directly leached from soil. Generally, nitrogen not recovered by crops goes into the large nitrogen pool in the soil. Factors affecting release of nitrate from these large soil reserves will affect the level of nitrate in the soil and, under drainage loss conditions, the rate of loss from the soil. (Jones-Wisconsin)
W71-13175

THE CONTROL OF EUTROPHICATION.
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland Waters; and Fisheries Research Board of Canada, Winnipeg (Manitoba); and Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.

Dep of Energy, Mines and Resources, Ottawa (Canada), Inland Waters Branch Technical Bulletin No 26. 10 p, 1 tab, 11 ref.

Descriptors: *Eutrophication, *Control, Lakes, Phosphorus, Detergents, Nutrients, Nitrogen, Water pollution, Carbon.
Identifiers: *Limiting nutrients, *Canada, Nutrient removal, Reformulation of detergents.

The respective roles of phosphorus, nitrogen, and carbon as critical elements of eutrophication are described. The most controllable of the essential elements for algal growth, and the key element in most important Canadian lakes is phosphorus. 60% of phosphorus in municipal wastes discharged to Lakes Erie and Ontario is from detergents thus detergent phosphorus accounts for about 40% of the total phosphorus loading to these lakes; human wastes account for most of the balance of the municipal discharge of phosphorus or about 25% of the total input. For the necessary drastic reduction of phosphorus loading, there must be reduction and eventual removal of phosphates from detergents, phosphate removal to the highest degree practicable at sewage treatment plants, and a program to reduce agricultural contributions through erosion control, improved fertilization practices and control of farm animal wastes. Phosphorus reduction is the only economically feasible solution at present and a logical starting point. Lakes can be saved if such a control program is instituted now. (Jones-Wisconsin)
W71-13176

CRUSTACEAN PLANKTON OF 146 ALPINE AND SUBALPINE LAKES AND PONDS IN WESTERN CANADA,
Calgary Univ. (Alberta). Canadian Wildlife Service.
R. S. Anderson.
Journal Fisheries Research Board of Canada, Vol 28, No 3, p 311-321, 1971. 6 fig, 4 tab, 50 ref.

Descriptors: *Biological communities, *Crustaceans, *Plankton, *Synecology, Alpine, Lakes, Ponds, Copepods, Temperature, Climax, Methodology, Altitude, Ecological distribution.
Identifiers: *Subalpine lakes, Western Canada, Planktonic crustaceans, Diaptomus arcticus, Anostraca, Jasper Nat Park (Alberta), Banff Nat Park (Alberta), Yoho Nat Park (British Columbia), Waterton Nat Park (Alberta), Alberta, British Columbia.

Crustacean plankton communities were studied in 146 lakes and ponds located in Banff, Jasper, Yoho, and Waterton Lakes national parks and some forest reserves in Alberta and British Columbia. Species composition varied little from year to year, showing a mean of 2.93 species per community. Except for a few lower subalpine lakes and ponds, no benthic macrophytes occurred, littoral and limnetic communities thereby all being considered limnetic. In four of the 146 waters studied, fish introduction resulted in a marked change in zooplankton species. Each of the four waters was considered as having two distinct communities. Diaptomus arcticus occurred in 60% of the communities. More clandoceran species than copepod species were found, but there were usually more copepod than cladoceran species in a community. Many species of subalpine waters did not occur in alpine waters, probably limited more by physical factors, as temperature and morphometry and presence of large predators than by altitude. Except for anostracans, few species seemed to be restricted to either lakes or ponds. Congeneric occurrences of large cladocerans or nonpredaceous diaptomid copepods were uncommon, as were co-occurrences of large cladocerans and nonpredaceous diaptomids. (Jones-Wisconsin)
W71-13180

A HYPOTHESIS CONCERNING SILICA AND THE FRESHWATER PLANKTONIC DIATOMS,
Duke Univ., Durham, N.C. Dept. of Zoology.
P. Kilham.
Limnology and Oceanography, Vol 16, No 1, p 10-18, 1971. 1 fig, 1 tab, 75 ref.

Descriptors: *Silica, *Plankton, *Diatoms, Eutrophication, Seasonal, Succession, Distribution patterns, Lakes, Systematics, Period of growth, Turbulence, Nutrients, Numerical analysis, Indicators.
Identifiers: *Silica demand, Stephanodiscus astraea, Tabellaria flocculosa, Asterionella formosa, Melosira granulata, Melosira italica subarctica.

Literature concerning ambient silica concentrations and its relation to dominance of specific freshwater planktonic diatoms is reviewed and analyzed. Compilations from literature indicate mean silica concentrations (mg/l) during dominance of Stephanodiscus astraea - 0.6, Tabellaria flocculosa asterionelloides - 0.9, Asterionella formosa - 1.7, Melosira granulata - 13.4. Available data clearly show that S astraea is most likely to reach its greatest importance in an eutrophic lake when silica concentration is below 1 mg/liter in contrast to M granulata which dominates high silica ecology. Appearance of A formosa in both oligotrophic and eutrophic environments complicates discussion of its ecology relative to silica. Although data are inconclusive, A formosa appears to be more successful than Mgranulata and less successful than S astraea in low silica, highly eutrophic environments. T flocculosa asterionelloides appears more successful than A formosa in low silica, oligotrophic or mildly eutrophic environments. Tabellaria and Stephanodiscus are indicators of oligotrophic and eutrophic conditions. Concentrations at time of dominance and patters of diatom periodicity in many eutrophic lakes led to the hypothesis that declining ambient silica concentrations may influence sequence of seasonal succession. When silica becomes depleted, diatoms become scarce. Some measure of 'silica demand' might become an index of increasing eutrophication. (Jones-Wisconsin)
W71-13181

ENTERIC BACTERIAL METABOLISM OF STREAM SEDIMENT ELUATES,
Georgia Univ., Athens. Dept. of Microbiology.
Charles W. Hendricks.
Canadian Journal of Microbiology, Vol 17, p 551-556, 1971. 3 fig, 4 tab, 21 ref.

Descriptors: *Enteric bacteria, *Metabolism, *Streams, *Sediments, Chemical analysis, Ammonia, Proteins, Respiration, Pathogenic bacteria, Adsorption, Nutrients, Sands, Eutrophication, Cycling nutrients, Laboratory tests, Water pollution effects, E coli, Rivers, Clays, Ecosystems, Aerobic conditions, Self-purification.
Identifiers: Hexoses, Escherichia coli, Enterobacter aerogenes, Proteus rettgeri, Shigella flexneri, Salmonella senftenberg, Arizona arizonae, North Oconee River (Ga).

Bottom sediments of lakes and streams play a major role in recycling nutrients; these nutrients contribute much to the observed heterotrophic growth which prompted this investigation concerning nutrient binding by river bottom sediments and conditions for removal and use by enteric bacteria. River bottom sediments, which were washed free of loosely associated chemical nutrients, were further eluted with phosphate buffer. Chemical analyses of the eluates indicated that 0.3 M buffer (pH 7.0)

eluted hexose, protein, and ammonia nitrogen in concentrations 4x6 times that found in the free-flowing water. Selected strains of Escherichia coli, Enterobacter aerogenes, Proteus rettgeri, Arizona arizonae, Shigella flexneri, and Salmonella senftenberg were used for respiration experiments and it was shown that they had ability to metabolize these substrates. These data indicate that both pathogenic and nonpathogenic bacteria could use substrates present in river water and those adsorbed on the bottom sediments after relatively mild laboratory treatment. Tests indicate that bottom sediments can have a high adsorptive capacity and suggest that they can regulate basic nutrient concentration and eutrophication in situ. A model for this phenomena can be proposed. (Jones-Wisconsin)
W71-13182

PRIMARY PRODUCTION,
Freshwater Biological Association, Ambleside (England).
J. W. G. Lund.
Journal of the Society for Water Treatment and Examination, Vol 19, Part 4, p 332-358, 1970. 6 fig, 1 tab, 36 ref, discussion.

Descriptors: *Water quality, *Eutrophication, *Primary productivity, *Algae, Nitrogen, Phosphorus, Thermal stratification, Water supply, Succession, Economics, Nutrients, Nitrogen fixation, Forecasting, Photosynthesis, Biomass, Nitrates, Reservoirs, Light penetration, Cyanophyta, Chrysophyta.
Identifiers: *United Kingdom, Esthwaite Water (England), Blelham Tarn (England), Luxury uptake, Loch Leven (Scotland), Lake Windermere (England).

Eutrophication is not yet a major economic problem in the British water industry but could become one and further support for ecological investigations is needed. The major nutrients, nitrogen and phosphorus, are studied with reference to ecological factors controlling algal population size and production rates. Typically, the degree to which the nutrient content of a reservoir approaches that of winter inflows is affected by retention time and number of algae present. Production rate is a guide to how troubles may increase and to dangers ahead when algae are relatively uncommon. The strong chemical stratification accompanying thermal stratification in eutrophic lakes makes it uncertain how great the nutrient supply can be to algae in the epilimnion or euphotic zone even in absence of active vertical migration. Thermal stratification may be advantageous or disadvantageous to water supply. Bioassay is a useful method for comparing potential fertilities of waters and for elucidating specific, limited problems. Other nutrients are important besides nitrogen and phosphorus. Forecasting development of algal populations and seasonal species' successions is possible in general terms but detailed forecasting over relatively long periods is not yet possible. (Jones-Wisconsin)
W71-13183

THE NUISANCE ALGAE: CURIOSITIES IN THE BIOLOGY OF PLANKTONIC BLUE-GREEN ALGAE,
Westfield Coll., London (England). Dept. of Botany.
A. E. Walsby.
Journal of the Society for Water Treatment and Examination, Vol 19, Part 4, p 359-373, 1970. 2 fig, 1 tab, 43 ref, discussion.

Descriptors: *Nuisance algae, *Cyanophyta, *Algal control, Laboratory tests, Buoyancy, Eutrophication, Nirtrogen fixation, Biocontrol, Plant physiology, Movement, Viruses, Photosynthesis, Turbulence, Light intensity.
Identifiers: *Gas vacuoles, Motile forms, Cyanophages.

Blue-green algae, quite different from all other algal groups, have certain characteristics which contribute to formation of blooms; one is the ability to fix atmospheric nitrogen. They possess gas filled vacuoles which provide a buoyancy-regulating mechanism enabling them to occupy water layers below the surface where conditions are optimal for growth, but also cause thick algal scums on the surface of lakes and reservoirs. On the credit side they produce oxygen which keeps the water in the aerobic condition essential for preventing growth of anaerobic bacteria and for supporting fish and other animal populations. They take up inorganic nutrients in growth and cleanse water of nitrate and other substances, potentially toxic. On the debit side, they contribute to the suspended solids which must be removed by filtering; their breakdown products, which pass filtering processes, may produce tastes and odors in treated water. Before breakdown occurs, soluble extracellular products, such as mucopolysaccharides, occasionally cause nuisance. Some produce toxic substances. Methods of destroying gas vacuoles or their effects would provide means of controlling algal blooms; another method might be to use cyanophages, viruses which attack these algae selectively. (Jones-Wisconsin)
W71-13184

EFFECTS OF LONG-TERM EXPOSURES TO COPPER ON SURVIVAL, GROWTH, AND REPRODUCTION OF BROOK TROUT (SALVELINUS FONTINALIS),
National Water Quality Lab. Duluth, Minn. Water Quality Office.
J. M. McKim, and D. A. Benoit.
Journal of the Fisheries Research Board of Canada, Vol 28, No 5, p 655-662, 1971. 3 fig, 5 tab, 25 ref.

Descriptors: *Water pollution effects, *Copper, *Fish physiology, *Toxicity, *Brook trout, Growth stages, Eggs, Juvenile fishes, Fry, Reproduction, Hardness (Water), Salmonids, Laboratory tests, Copper sulfate, Spawning, Incubation, Hatching, Water quality.
Identifiers: *Long-term effects, *Salvelinus fontinalis.

Long-term effects of copper concentrations on all devleopmental stages of brook trout were investigated and a copper application factor calculated. Foel22 months all developmental stages were exposed to copper concentrations ranging from 32.5 to 1.9 micrograms/liter. Highest concentration decreased survival and growth of adults and reduced number of viable eggs and hatchability. Survival, growth, and reproductive success of adults in copper concentrations 17.4 to 3.4 micrograms/liter did not differ from the control (1.9 micrograms/liter). Concentrations of 32.5 and 17.4 micrograms/liter were adverse to alevins and juvenile survival and growth. Copper effects on alevins-juveniles from unexposed parents did not differ from those with parents exposed to copper. The maximum acceptable toxicant concentration for brook trout exposed to copper in water (hardness 45 mg/l as calcium carbonate) and a pH 7.5 fell between 17.4 and 9.5 micrograms/liter copper. The mean 96-hour median tolerance limit for 14-month-old brook trout exposed to copper was 100 micrograms/liter, and the application factor, maximum acceptable toxicant concentration per 96-hour median tolerance limit for Lake Superior's soft water lies between 0.17 and 0.10. (Jones-Wisconsin)
W71-13186

THE ECOLOGY OF SAPROLEGNIACEAE IN LENTIC AND LITTORAL MUDS WITH A GENERAL THEORY OF FUNGI IN THE LAKE ECOSYSTEM,
Reading Univ. (England). Dept. of Botany.
M. W. Dick.
Journal of General Microbiology, Vol 65, p 325-337, 1971. 5 fig, 4 tab, 9 ref.

Descriptors: *Fungi, *Ecological distribution, *Distribution patterns, Lentic environments, Littoral, Lakes, Energy transfer, Aquatic fungi, Sampling, Submerged plants.
Identifiers: *Saprolegniaceae, *Marion Lake (British Columbia), Achlya, Oomycetes, Emergent sites, Saprolegnia, Acidophile sites, Lentic muds.

In order to evaluate particular sites of activity of Saprolegniaceae, their principal natural substrates, and their role in lake ecosystem productivity, comparative accounts of relative abundance or distribution between littoral and lentic environments in and around Marion Lake, British Columbia, Canada, were investigated by single-core samples and transects. Twenty-one Saprolegniaceae species, as well as non-sexual Achlya and Saprolegnia have been recorded. The lentic muds under 1 m or more of water are generally poor both in species number and abundance. Marginal lentic muds are richer but reflect the flora of emergent littoral muds. Many lentic mud records are probably for alien spores originating either from open water community or emergent littoral flora while Saprolegniaceae species may follow different pathways. Species of certain environments, such as those associated with insect exuviae, are more obviously involved in the pattern of energy flow than others. It appears probably that most Saprolegniaceae are primarily fungi of the emergent littoral and lentic/littoral interfaces and very few are clearly lentic. Both groups contribute to the lake ecosystem energy flow. The distinctive acidophile community has again been recognized. (Jones-Wisconsin)
W71-13188

PRODUCTIVITY AND UTILIZATION OF FOOD ENERGY BY BENTHONIC BIOCOENOSES IN TWO NORTHERN LAKES (Produktivnost i ispolzovanie energii pishchi v donnykh biotsenozakh dvukh severnykh ozer), (In Russian),
Akademiya Nauk SSSR, Leningrad. Zoologicheskii Institut.
A. F. Alimov, and N. P. Finogenova.
Doklady Akademii nauk SSSR, Vol 197, No 2, p 460-463, 1971. 1 fig, 4 tab, 5 ref.

Descriptors: *Biological communities, *Trophic levels, *Benthos, *Productivity, Energy budget, Herbivores, Carnivores, Food habits, Metabolism, Lakes.
Identifiers: Krivoye Lake (USSR), Krugloye Lake (USSR).

Balance of energy was determined in benthos associations of a 50 ha, 30 m deep lake, and a 10 ha, 4 m deep lake, located on shores of the White Sea. Analyses delineated five biocoenosis units in the large, and two units in the small lakes, using the index of faunistic similarity: c — 100 d / (a .. b - d), where a and b represent the number of species in each community, and d the total number of species. Each biocoenos included two trophic levels: 'harmless' detritophages and filtrators, and predatory Procladius Skuse and Hydracarina. The balance of energy was determined as the difference between the total production of all benthos organisms minus the ratio of predators. A negative production, obtained for Phisidium crassum, indicated that some predators either indulge in cannibalism or supplement their diet by vegetation. The coefficient of useful performance of biocoenosis varied from 3 to 22%, with the average of 13%. (Wilde-Wisconsin)
W71-13190

NEW AQUATIC HYPHOMYCETES,
Exeter Univ. (England). Dept. of Biological Sciences.
S. H. Iqbal.
Transactions of the British Mycological Society, Vol 56, No 3, p 343-352, 1971. 5 fig, 10 ref.

Descriptors: *Aquatic fungi, *Speciation, Habitats, Varieties.
Identifiers: *Hyphomycetes, *New species, Varicosporium delicatum, Tricladium gigantium, Tricladium attenuatum, Centrospora aquatica, Aceri pseudoplatani, River Noe (Derbyshire, England).

Latin diagnoses and illustrations are given for four new Hyphomycetes found in England. Varicosporium delicatum was found on decorticated submerged leaves of Aceri pseudoplatani in the River Noe, Edale Valley, Derbyshire, in June and July 1969. Foam samples also showed delicate branched spores. In discussing its taxonomy a similarity with Tricladium and Polycladium are suggested and comparisons with Varicosporium elodeae and Varicosporium giganteum are given. Tricladium giganteum was found on immersed, decaying leaves of Crataegus monogyna and in grass leaves in the River Noe. It is compared taxonomically to Tetrahaetum elegans and Tricladium intermedium. Morphologically it provides a link between the condition in Tricladium (as exemplified by type species T splendens) and Geniculospora. Tricladium attenuatum was found on decaying submerged leaves of Crataegus monogyna, Trobridge Crediton, in March to April 1970. Centrospora aquatica was found on a rotten submerged branch in the river, Dartmoor, January 1970. (Type specimens for the four new species are E219, E220, E221 and E222, respectively in the Mycological Herbarium, University of Exeter.) Cultures are being deposited in the Commonwealth Mycological Institute, Kew, and the Centraalbureau voor Schimmelcultures, Baarn. (Jones-Wisconsin)
W71-13191

RADIOECOLOGY RESEARCH IN TARANTO GULF. PART 1: RADIOMETRIC MEASUREMENTS ON SEA WATER, PLANKTON, BENTHIC ORGANISMS AND SEDIMENTS,
Parma Univ. (Italy). Instituto di Zoologia e Antatomia Comparata.
B. Schreiber, L. Tassi Pelati, and M. G. Mezzadri.
Revue International D'Oceanographie Medicale, Vol 21, p 135-165, 1971. 7 fig, 9 tab, 10 ref.

Descriptors: *Water pollution effects, *Radioactivity, *Sea water, *Plankton, *Benthos, *Sediments, *Potassium, Aquatic organisms, Ecology.
Identifiers: *Beta values, Taranto Gulf, Ionian Sea, Ligurian Sea.

A survey to measure the gross beta radioactivity in sea water, plankton, benthic organisms and sediments of the Taranto Gulf was conducted from July to September 1968. Potassium contents were determined in the various substrates and potassium 40 contribution to the gross beta radioactivity value was calculated in the different samples. Plankton was found to have an artificial radioactivity value higher than 80% of the total, other biological samples had a considerable percentage of artificial radioactivity, sediments had about 10% of the total and sea water was so low the value could not be determined with the method used. Observations for the comparison of radioactivity values in the Ionian and Ligurian Seas proved to be the same for the two areas during the period studied. (Ensign-PAI)
W71-13229

SELECTIVE ASSUMPTION OF Mn 54 BY THE MOLLUSC PINNA MOBILIS,
Padua Univ. (Italy). Istituto di Igiene.
G. G. Calapaj, and D. Ongaro.
Revue Internationale D'Oceanographie Medicale, Nice, France, Vol 21, p 125-133, 1971. 4 fig, 5 ref.

Descriptors: *Water pollution effects, *Manganese, *Molluscs, *Sea water, *Radioisotopes, *Absorption, Selectivity.
Identifiers: *Pinna nobilis, Half life.

Aspects of the assumption of manganese 54 by the mollusc Pinna nobilis have been studied. The rate of assumption was found to increase with the concentration of the radioisotope in sea water and to decrease following the addition of stable Mn. Equilibrium was reached within the 6th day with Mn 54 concentration of 0.5 pc/ml. The effective half life of Mn 54 in Pinna was found to be shorter than the physical one. (Ensign-PAI)
W71-13230

SR-85 AND CS-134 UPTAKE BY FRESHWATER SESTON,
European Atomic Energy Community, Ispra (Italy). Biology Div.
O. Ravera.
Revue Internationale D'Oceanographie Medicale, Nice, France, Vol 21, p 109-124, 1971. 2 fig, 2 tab, 44 ref.

Descriptors: *Water pollution effects, *Radioactivity, *Strontium radioisotopes, *Cesium, *Aquatic organisms, *Biomass, *Seston, Adsorption, Absorption, Crustaceans, Phytoplankton.
Identifiers: *Granulometric fractions, Italy.

Strontium-85 and Cesium-134 concentrations in different granulometric fractions of seston collected in Lake Monate, Italy are determined. These data indicate that Cladocerans concentrates Sr-85 to the highest degree and phytoplankton Cs-134. It is assumed that absorption radionuclides predominates over adsorption. Schematization of the vertical distribution of radiostrontium and radiocesium present in different granulometric fractions is attempted from the data on the distribution of the biomass of seston at different depths and the concentration of two radioisotopes computed in different granulometric fractions of seston. (Ensign-PAI)
W71-13231

OBSERVATIONS CONCERNING THE EXPERIMENTAL CONTAMINATIONS AND THE 'IN SITU' CONTAMINATIONS OF MARINE SPECIES BY RUTHENIUM 106, (OBSERVATIONS CONCERNANT LES CONTAMINATIONS Experimentales et les contaminations 'in situ' d'especes marines par le'ruthenium 106),
Commissariat a l'Energie Atomique, Cherbourg (France). Centre de la Hague.
J. Ancellin, and P. Bovard.
Revue Internationale D'Oceanographie Medicale, Nice, France, Vol 21, p 85-92, 1971. 8 ref.

Descriptors: *Water pollution effects, *Plants, *Animals, *Algae, *Invertebrates, *Radioactivity effects, *Radioisotopes.
Identifiers: *Ruthenium 106, Soluble forms, Insoluble forms, Laboratory experiments.

Contamination of marine flora and fauna by Ruthenium 106 was studied under both laboratory and In situ conditions. Algae and invertebrates contaminated by soluble and insoluble forms of Ruthenium 106 indicated that the soluble Ru 106 was 5-10 concentration factors lower than the insoluble Ru 106 forms. The high amounts of concentration factors observed In situ were usually comparable to those experimentally determined for the soluble forms in both algae and invertebrates. (Ensign-PAI)
W71-13233

EVALUATION TESTS OF THE TRANSFER OF RADIOACTIVE POLLUTION IN THE OCEANIC AND MARINE FOOD CHAINS, (ESSAI D'EVALUATION DES TRANSFERTS DE LA POLLUTION RADIOACTIVE DANS Les chaines alimentaires oceaniques et marines),
Commissariat a l'Energie Atomique, Fontenay-aun-Roses (France).
R. Bittel, and G. Lacourly.
Revue Internationale D'Oceanographie Medicale, Nice, France, Vol 21, p 75-83, 1971. 5 ref.

Descriptors: *Water pollution effects, *Sea water, *Radioactivity, *Radioisotopes, *Marine animals, *Food chains, Radioactivity effects, Aquatic populations, Human diseases, Public health.
Identifiers: Water contamination levels.

Food along with inhaled air and ingested water is a main contributing factor of radiocontamination in humans. In agreement with the latest International Commission of Radiologic Protection recommendations a proposal is made to employ water contamination levels instead of maximal concentrations admissable. Tests of the transfer of radioactive pollutants along the marine food chain were studied. The variability of the parameters in assessing the dose ingested from sea food was analysed and the incidence of this variability tested. Several typical examples were treated to confirm the study. Priorities of research projects were discussed and a model for future studies on chemical pollutants of the aquatic environment proposed. (Ensign-PAI)
W71-13234

SANITATION PROBLEMS OF THE LITTORAL OF GUIPUZCOA, SPAIN (PROBLEMES SANITAIRES DU LITTORAL DE GUIPUZCOA (ESPAGNE)),
Services Provinciaux de Guipuzcoa, San Sebastian (Spain).
Dr. L. Contreras.
Revue Internationale D'Oceanographie Medicale, Nice, France, Vol 20, 1970. p 151-169.

Descriptors: *Water pollution effects, *Sea water, *Coasts, *Marine animals, *Environmental sanitation, Epidemiology, Diseases, Public health.
Identifiers: *Spain.

Sanitary problems caused by water pollution of the coastal province of Guipuzcoa, Spain, and the incidence of infectious epidemiology on populations in areas near urban and recreation centers are studied. The necessity of serious epidemiologic inquests as to the degree of coastal contamination is emphasized. A constant systematic microbiological, physicochemical control of the marine environment to prevent or limit the contamination hazards is suggested. (Ensign-PAI)
W71-13237

(LE ROLE DES INVERTEBRES MARINS DANS LE CUMUL ET LE TRANSPORT DES RADIONUCLEIDES), THE ROLE OF MARINE INVERTEBRATES IN THE ACCUMULATION AND TRANSPORT OF RADIONUCLIDES,
Comitato Nazionale per l'Energia Nucleare, La Spezia (Italy). Laboratorio per lo Studio della Contaminazione Radioattiva del Mare.
A. Nassogne.
Revue Internationale D'Oceanographie Medicale, Nice, France, Vol 20, 1970, p 79-99. 44 ref.

Descriptors: *Radioisotopes, *Marine animals, *Absorption, *Metabolism, Physicochemical properties, Adsorption, Feeding rates, Food chains, Public health, Invertebrates.
Identifiers: *Concentration, *Transport.

Predicting the radiocontamination levels for marine organisms in order to determine the maximum quantities of discharge permissible is urgent. Determination of Concentration Factors in natural and experimental conditions for the most important radionuclides in various groups of organisms is useful even though Concentration Factors give only a rough comparison between the concentration of an isotope in an organism and that in the sea. Animal metabolism and physico-chemical factors in the marine environment can also greatly influence uptake and accumulation of radionuclides and therefore change the Concentration Factor. Data of the literature on metabolism of some radionucludes in marine invertebrates along with the importance of adsorption, feeding and physicochemical states are collected and presented. Directly regulated, indirectly regulated and non regulated elements are defined. The possibility of more accurately predicting radiocontamination hazards is discussed. (Ensign-PAI)
W71-13241

THE POSSIBLE ROLE OF MARINE BACTERIA IN THE RECYCLING OF RADIONUCLIDES IN SEA WATER,
Comitato Nazionale per l'Energia Nucleare, La Spezia (Italy). Laboratorio per lo Studio della Contaminazione Radioattiva del Mare.
C. Peroni.

Revue Internationale D'Oceanographic Medicale, Nice, France, Vol 20, 1970, p 53-77. 27 ref.

Descriptors: *Radioisotopes, *Sea water, *Marine bacteria, *Metabolism, *Trophic level, Food chains, Absorption, Physiological ecology, Calcium, Cesium.
Identifiers: Uptake, Transfer, Strontium, Yttrium, Zinc, Cesium.

The possible functions performed by bacteria in the marine environment are discussed with emphasis on the transfer of radionuclides through the marine food chain. A review is given of data from literature concerning the uptake of the radionuclide of Sr, Y, Ca, Zn, Cs, and Ce by marine bacteria and the transfer of the radioisotopes p32 and Mn54 to higher trophic levels by bacteria associated with marine animals. Examples are given of food chains whose first step is represented by the utilization of dissolved organic matter by bacteria. The relationship is discussed between organic matter present in the marine environment and the number of metabolically active bacteria detected by an autoradiographic method. (Ensign-PAI)
W71-13242

THE ROLE OF ALGAE IN CYCLING OF RADIONUCLIDES,
Comitato Nazionale per l'Energia Nucleare, La Spezia (Italy). Laboratorio per lo Studio della Contaminazione Radioattive del Mare.
A. Lattera, and M. Bernhard.
Revue Internationale D'Oceanographie Medicale, Nice, France, Vol 20, 1970, p 29-52. 67 ref.

Descriptors: *Radioisotopes, *Algae, *Sea water, *Food chains, *Absorption, Biochemistry, Physiological ecology, Cesium, Strontium radioisotopes, Linc radioisotopes, Manganese, Cobalt radioisotopes, Cadmium radioisotopes, Metabolism, Trophic levels.
Identifiers: Concentration, Abundance, Iron, Chromium, Copper, Nickel, Ruthenium, Cerium, Linconium.

Uptake, loss and stable content for elements which possess possible dangerous radioisotopes, and the factors influencing these are discussed. The accumulation of trace metals by algae was proportional to their external concentrations. Uptake was related to physico-chemical forms of radio-nuclides. Concentration factors for the different elements were found to vary, sometimes to more than a thousand times over their concentration in the environment. (Ensign-PAI)
W71-13243

THE FACTORS LIMITING REALIZATION OF THE FULL POTENTIAL OF RESOURCES OF THE COASTAL ZONE,
Bureau of Commercial Fisheries, Woods Hole, Mass.
R. L. Edwards.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970, Miami Beach, Florida, p 19-21.

Descriptors: *Commercial fishing, *Food abundance, *Coasts, Fish, Fishing, Fish management, Fisheries, International waters.

In 1968, the total fishery resources of the United States were estimated at 20 million metric tons, or a little more than one-third of the total world catch of marine fishes today, and are now probably lower. Limited resources and increased demand require greater imports of fishery products, especially shrimp. The sea is not inexhaustible and competition for its resources is great, between nations, between commercial and sport fishermen, and between those who fish the high seas and those who fish the estuaries and fresh water. To harvest the full potential of our coastal marine areas, a method must be found of dealing with the problem of allocation as a whole, instead of piecemeal, one species at a time, as before. (See also W71-12029) (Smith-PAI)
W71-13245

ECONOMIC ASPECTS OF ALGAE,
Louisville Univ., Ky. Dept. of Biology.
V. E. Wiedeman.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970, Miami Beach, Florida, p 25-33. 2 tab, 60 ref.

Descriptors: *Marine algae, *Economics, *Productivity, Algae, Resources, Food chains, Fish food organisms, Oxygen, Ecosystems.

Algae provide the main food supply in the sea and have great economic importance. The blue-green algae (Cyanophycophyte) are primitive organisms resembling bacteria and incorporating a nitrogen fixing capability which causes high biomass production. They should be fully investigated for economically useful metabolites. The green algae (Chlorophycophyta) are of great diversity but certain genera show potential as a protein-rich food source, as soil fertilizer, and as a lead to further understanding of the photosynthetic process and cytology. Euglenoid flagellates (Euglenophycophyta) can be used as bioassay organisms for Vitamin B12, and some occur as a major component in waste-stabilization ponds. Certain of the golden algae (Chrysophycophyta) are utilized in vitamin assay but have an unpleasant odor and taste in water. The diatoms (Bacillariophycophyta) can be used for insulating, scouring and filtering materials, and some species have antibiotic properties. The brown algae (Phaeophycophyta), which include kelp, are a source of iodine, dried food, fodder, fertilizer and algin, which has many uses in modern products. The red algae (Rhodophycophyta) have similar useful properties, whereas the dinoflagellates (Pyrrophycophyta) need to be controlled because of toxic properties. Algae thus constitute the base of most food chains and contribute most of the world's oxygen supply. (See also W71-12029) (Smith-PAI)
W71-13246

MARINE ORGANISMS AS A PROMISING NEW SOURCE OF DRUGS AND BIOLOGICALLY ACTIVE AGENTS,
Oklahoma Univ., Norman. Dept. of Chemistry.
A. J. Weinheimer, M. M. Sigel, W. Lichter, and I. I. Wellham.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970, Miami Beach, Florida, p 35-43. 9 fig, 9 ref. HE-05675, PH 43-67-1179, PH 43-63-622, PH 43-64-890.

Descriptors: *Marine microorganisms, *Biological properties, *Chemical properties, Biochemistry, Plant physiology, Research and development, Organic compounds, Human diseases, Marine plants, Marine animals, Resource development.
Identifiers: Hydrocarbons.

Marine organisms contain biologically active substances which can be toxic but also have potential therapeutic utility because of their diverse pharmaco-dynamic actions. Exploration and utilization of naturally occurring compounds in the marine environment for valuable biologically active agents is long overdue. Biologists must learn more about the distribution and environmental condtions of useful plants and animals. Chemists must examine the active components and identify their chemical structures, with a view to possible synthetic processes. Figures illustrate antitumor activity detected in crude extracts from some marine animals and plants. Further studies are being made of gorgonians, a group of coelenterates, which contain terpenoid compounds. Compounds contained in the lipid fraction and the more polar compounds are being investigated. Several hydrocarbons, including representatives of the sesquiterpene (C15) and diterpene (C20) groups, have been isolated and are illustrated. Some of the compounds had not previously been found in nature, and some had been encountered only in terrestrial plants. Certain compounds are effective in inhibiting the growth of human carcinoma cells maintained in tissue culture. Further work is planned for determining the physiological activities exerted by the several chemically defined substances derived from the marine organisms. (See also W71-12029) (Smith-PAI)
W71-13247

COMMERCIAL AND RECREATIONAL FISHERY RESOURCES OF ESTUARINE WATERS, SOUTHERN UNITED STATES,
Miami Univ., Fla. Rosenstiel School of Marine and Atmospheric Science.
C. W. Caillouet.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970, Miami Beach, Florida, p 44-48. 25 ref.

Descriptors: *Estuarine environment, *Estuarine fisheries, Estuaries, Brackish-water fish, Shellfish, Food abundance, Natural resources, Conservation, Productivity, Commercial fishing, Sport fishing.
Identifiers: *Southern United States, Gulf of Mexico.

The relationship between the most important fishery resources and the estuarine environment of the southern states is examined. The five southern states bordering the Gulf of Mexico provide a large proportion of the total seafood landings in the United States. The 17,000 to 20,000 miles of estuarine waters in this area are all shallow coastal bodies into which fresh water is discharged and into which tidal sea water flows. The outflow of the Mississippi River makes the region one of the most productive fishery areas of the world, mainly for estuarine species. Adults spawn in the Gulf, larvae move into the low-salinity estuarine waters which are high in nutrients, develop there and then return to the sea, as illustrated by the life history of the commercially valuable brown shrimp. Plant and leaf detritus from mangrove forests and marshes provide most of the nutrition for the aquatic animal community, and these forests must be protected for environmental, commercial and recreational reasons. (See also W71-12029) (Smith-PAI)
W71-13248

THE CONSERVATION OF MARINE SPECIES AND AREAS,
Smithsonian Institution, Washington, D.C. Office of Environmental Sciences.
I. E. Wallen.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970, Miami Beach, Florida, p 52-60.

Descriptors: *Marine animals, *Marine plants, *Conservation, Oceans, International commissions, Preservation, Distribution patterns, Aquatic habitats, Ecology, Environmental effects, Research and development, Islands.
Identifiers: *Marine preserves.

In contrast to terrestrial natural areas, very few areas have been preserved in the marine environment, such as underwater parks. Several facilities of the Smithsonian Institution have become interested in the distribution of marine preserves, and the identification and stability of biological populations. The utilization of marine species, as food organisms and for biological chemicals is far behind agriculture. This is one reason why the ocean environment must be kept as free of pollution as possible. It is hoped to establish three typical marine preserves by international treaty for study and reference, but finances and support are a problem. Much more knowledge is needed of marine animal biology and habitats in order to protect endangered species. Marine preserves must be selected as control areas to provide information on the natural state of specific areas, with a view to possible simulation, and as regions for repopulation and replenishment. There are many aspects of marine-resources planning to be taken into account. A list of undisturbed Pacific oceanic islands

has been proposed for international scientific supervision. Marine preserves are a necessary part of the maintenance of a quality environment and need the support of government and citizens. (See also W71-12029) (Smith-PAI)
W71-13249

CHANGING POLITICAL ATTITUDES TOWARD BIORESOURCE CONSERVATION AND DEVELOPMENT,
Friends of the Earth, Washington, D.C. 917 15 St. N.W. 638-2525.
J. E. Browder.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970, Miami Beach, Florida, p 62-66.

Descriptors: *Water resources, *Resource development, *Conservation, Flood plain zoning, Governments, Institutions, Natural resources, Social aspects, Political aspects, National parks.

The politics of water resources uses, management and conservation is changing and there is some conflict between the various government, academic and local institutions which are involved. An example of this is the controversy between conservationists and representatives of flood control districts in the selection and extent of areas to be flooded. Some people in water resource management still view natural areas as places to be commercially exploited. Today, however, citizen groups are becoming more knowledgeable and articulate bout the environment. The question of the Cross Florida Barge Canal can be used to show that the old justifications for doing things do not hold true anymore. Concerned citizens are also becoming more aware of government pressure in questions of water-resource use, and how to deal with it. The Everglades National Park water controversy may hopefully be the end of the conflict between flood-control districts and the Corps of Engineers and the National Park, because informed citizen organizations can now work effectively at a state and national level. The important point is that the facts of any such situations should be made widely and clearly known. (See also W71-12029) (Smith-PAI)
W71-13250

THERMAL STUDIES FOR HEATED WATER SYSTEMS,
Virginia Univ., Charlottesville. Dept. of Mechanical Engineering.
C. S. Chen, and J. T. Beard.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970, Miami Beach, Florida, p 70-87. 7 fig, 1 tab, 39 ref. OWRR A-019-VA ( ).

Descriptors: *Water resources, *Evaporation, *Thermal properties, Evaporation control, Analytical techniques, Mathematical models, Equations, Model studies, Nuclear power plants, Heat transfer, Cooling towers, Performance, Theoretical analysis.
Identifiers: Interferometer.

Thermal history and evaporative losses from a water system are considered. Investigators have attempted to develop analytical and experimental techniques for conveniently predicting evaporative loss and the various parameters that influence it, and their work is noted. An analytical model was developed for determining the surface temperature variation and the daily evaporation rate from a water surface. The conduction and surface node equations for a typical water element are given. Equations for the incident solar energy, the solar energy reflected, long wave energy exchange, convection heat transfer and energy of evaporation are also set out. Typical seasonal weather conditions and evaporation results are summarized in a table. The second part of this work deals with transport phenomena in natural draft cooling towers, which seem to provide the best method of reducing the heat rejected by nuclear plants. The heat-transfer problem in a counter-flow cooling tower operation is investigated and the experimental set-up is described. A Mach-Zehnder interferometer is used for simultaneous measurement of temperature and concentration gradients in the air vapor boundary layer. Analysis of these gradients provides the basis for determination of heat transfer coefficients. Theoretical prediction involves solution of a system of equations utilizing the transport and physical properties obtained from actual experimental measurements. (See also W71-12029) (Smith-PAI)
W71-13251

THE MEASUREMENT OF OUR NATURAL RESOURCES,
New England Aquarium, Boston, Mass.
G. C. McLeod.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970, Miami Beach, Florida, p 88-98. 2 fig, 30 ref. N00014-69-C0380.

Descriptors: *Marine algae, *Light, *Growth rates, Phytoplankton, Natural resources, Depth, Distribution patterns, Measurement, Photosynthesis, Plant physiology, Pigments.
Identifiers: Submarine light data sphere.

Over short periods of time algae photosynthesize faster than they grow. The light-intensity curve for growth of algae is an intrinsic characteristic of the algae used and the temperature, whereas that of photosynthesis is not. Measurements of productivity of algae must consider the variability in synthesis of storage materials and important pigments. The question of light response may influence the dominance of certain phytoplankton in selected environments. Some studies of the effect of light intensity on the growth, pigment composition and metabolism of fresh water and marine phytoplankton are described. The intensity and spectral composition of light in the marine environment is variable. The effects of spectrum-limited light on growth, pigmentation and photosynthesis have only recently been studied in chromatic light and darkness. The effects of blue light can be reversed by increments of red light. The kinetics of the adaptation to blue light and a possible mechanism of action are considered. Species must adapt to the changes in spectral composition of submarine light, therefore the distribution of certain species at certain times of year will vary. A submarine light data sphere is specified, with systems for measuring total integrated intensity of light over time as a function of depth. (See also W71-12029) (Smith-PAI)
W71-13252

ENGINEERING RESPONSIBILITIES IN PROTECTING THE MARINE ENVIRONMENT,
Water Pollution Control Federation, Washington, D.C.
G. W. Burke, Jr.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970, Miami Beach, Florida, p 99-104.

Descriptors: *Environmental engineering, *Water reuse, Waste water treatment, Waste water disposal, Eutrophication, Engineerig, Political aspects, Decision making, Public benefits, Water pollution control.

Withdrawal uses of water and the return of the used waters to the environment are discussed. Discharges of wastewater are increasing and require advanced treatment methods by engineers and scientists to prevent pollution. The engineer must design the treatment plant to produce the required effluent. Quality of effluents is becoming of widespread concern but demands for protecting the environment must be viewed realistically. Studies are being made on the use of waste heat and the problem of eutrophication, and engineers should be involved in such work from the beginning as they will be responsible for ultimate plant development. Engineers can promote ideas and better ways of doing things by being more involved with the politics of decision-making. Santee, California, is an excellent example of how useful and acceptable water supplies can be prouced from wastewaters. The public can also be shown that conventional plants can be operated more efficiently. The engineering community has the capacity for objective analysis and the capability of selling its solutions to others, which it must exercise in order to increase its influence on governmental affairs and preserve its independence. (See also W71-12029) (Smith-PAI)
W71-13253

PATTERNS OF DISTRIBUTION OF COASTAL BIOTA, REMOTE SENSING, AND CONSERVATION OF RESOURCES,
Virginia Univ., Charlottesville. Dept. of Environmental Science.
M. G. Kelly.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970, Miami Beach, Florida, p 105-113. 6 fig, 7 ref. N62306-70-A-0075-0003.

Descriptors: *Coasts, *Aerial photography, Biological communities, Natural resources, Water resources, Remote sensing, Sediment distribution, Currents, Bottom sediments, Suspension.

A better knowledge of normal coastal ecosystems is required in order to understand the effects of man's exploitation of coastal waters. Too little is known of the distribution of marine communities and water masses. Bottom material and material suspended in the water have been studied using aerial photography. Three sites photographed from heights of 12,000 feet and 60,000 feet were the west edge of the Bahama Banks, the Biscayne Bay and Florida Keys area, and the New York-Long Island area. Bottom sediment samples and water samples were examined. Bottom vegetation was clearly visible and there was little suspended material in the Florida Straits waters, whereas in the New York area bottom vegetation was visible only at very shallow depths and there was more suspended material. Several examples of the photographic are given and explained, though data analysis is still in progress. Satellite photographs of coastal areas are also examined. Distribution of suspended materials can be monitored, and patterns and types of bottom vegetation can be analyzed. This type of photography should allow a much better understanding of coastal circulation and of the distribution and changes of biological communities. The biological and physical processes that produce the images still need further study. (See also W71-12029) (Smith-PAI)
W71-13254

FERTILITY AND AQUATIC BIOMASS IN SOUTHEASTERN IMPOUNDMENTS,
Auburn Univ., Ala. Agricultural Experiment Station.
J. M. Lawrence.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970, Miami Beach, Florida, p 115-126. 1 fig, 1 tab, 2 ref.

Descriptors: *Impoundments, *Nutrients, *Biomass, Aquatic environment, Water quality, Fertility, Productivity, Aquatic plants, Sampling, Measurement.
Identifiers: Southeastern United States.

The ranges of major nutrient concentrations in surface waters and their subsequent assimilation into biomass in selected impoundments in the southeastern United States are discussed. Four different types of impoundments, ranging in area from one-tenth of an acre to 45,000 acres, were selected for comparative studies. Water and nutrient supplies to the two smaller types of impoundments were controlled and fish population was estimated. Inflow, drainage and outflow occurring in the other impoundments were calculated. Samples of water, suspended matter and rooted aquatic plants were collected during a seven-month period. Compara-

tive data on the efficiency of utilization of available nutrients by the aquatic biomass, including fish population, of each of the impoundments are tabulated. The five nutrients, N, P, K, Ca and C were determined. Nutrient input and output are shown in pounds per acre. The small impoundments with controlled water supplies apparently assimilated nutrients into aquatic biomass more efficiently than the larger, flow-through types. The most efficient system involved direct conversion of fish feed into fish flesh. The most effective aquatic plant converter was the waterhyacinth which was also the most likely cause of nuisance growth in subtropical environments. (See also W71-12029) (Smith-PAI)
W71-13255

EUTROPHICATION: A THREAT TO WATER RESOURCES,
Environmental Protection Agency, Corvallis, Oreg. Pacific Northwest Water Lab.
A. F. Bartsch.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970, Miami Beach, Florida, p 127-135. 15 ref.

Descriptors: *Water quality control, *Lakes, *Eutrophication, Aquatic algae, Nutrients, Water resources, Waste assimilative capacity, Research and development, Waste water treatment.
Identifiers: Nutrient control methods.

Quality deterioration of water resources, especially lakes, through eutrophication is a worldwide problem and requires immediate action. The natural process has been aggravated and speeded up by man's activities in augmenting the fertility of water. Artificially created lakes quickly develop eutrophication problems. Industrial wastes, sewage wastes and agricultural runoff all contribute nutrients to watercourses. The question of lake restoration is being studied by scientific communities and the FWQA. One restorative and preventive approach is to curb nutrient input, which is already being done in some places by diverting sewage from lakes. A SECOND CONTROL POSSIBILITY IS TO TREAT SEWAGE AND WASTES TO STRIP THEM OF THEIR NUTRIENT CONTENT, ESPECIALLY PHOSPHORUS. However, all lakes are different and there is need to be able to predict how quickly and how much a lake will change after restorative efforts. Detergents are another source of phosphorus in sewage which must be controlled. Improved handling of agricultural wastes can also minimize nutrient input to water. Studies are being made of the use of certain chemicals for nutrient inactivation. Other ideas under consideration are the feeding and harvesting of algae, controlled dredging, stimulating diseases and parasites to destroy plant populations, and, as a last resort, the use of algicides and herbicides. (See also W71-12029) (Smith-PAI)
W71-13256

BACTERIA-ALGAE SYMBIOSIS - A CAUSE OF ALGAL BLOOMS,
Wyandotte Chemicals Corp., Mich.
L. E. Kuentzel.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970, Miami Beach, Florida, p 136-145. 23 ref.

Descriptors: *Algae, Bacteria, *Lakes, Symbiosis, Algal control, Eutrophication, Water pollution, Biochemical oxygen demand, Organic matter, Phosphorus, Carbon dioxide.

The existence of the mutually beneficial symbiotic relationship between blue-green algae and certain bacteria is well established. The presence of biodegradable organic matter will always contribute to massive algal bloom growth if all other factors permit, and there has been a general inclination to turn to phosphorus as a controlling factor. The logistics of supply for CO2 and P are examined in the light of the established requirements for the growth of massive algal blooms in increasingly polluted lakes, and findings from previous and new studies are cited. Nutrient control has little effect on lakes which have been supporting algal growth for several years because of the accumulation of organic debris. It appears that organic matter and bacterial action play a major role in supporting algal bloom development. Attempts to control algal growth via control of carbon (BOD) offer distinct advantages, whereas phosphate removal does not seem to have much effect. Wastewaters need to receive optimum BOD and ammonia N removal by treatment plants to help prevent eutrophication of rivers and lakes. (See also W71-12029) (Smith-PAI)
W71-13257

ORGANIC LIFE IN THE DELTA-MENDOTA CANAL, CALIFORNIA,
Bureau of Reclamation, Sacramento, Calif. Region 2.
N. P. Prokopovich.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970, Miami Beach, Florida, p 191-202. 10 fig, 10 ref.

Descriptors: *Canals, *Biological communities, Sediments aquatic life, Bottom sediments, Clams, Fish, Plankton, Water conveyance, Data collections, California.
Identifiers: Delta-Mendota Canal (Calif).

Studies of organic life in the Delta-Mendota Canal, California, constructed solely for water conveyance, were made during seven winter dewaterings and data was collected and studied on sediments and organisms. Biota composition and distribution was different during the dewaterings compared with during regular canal operations. The canal is located in the northwestern part of the semiarid San Joaquin Valley and the source of water is the eutrophic complex of the Sacramento-San Joaquin Delta. During dewaterings isolated deposits of clam-bearing sediments were noted. Large numbers of filter-feeding organisms indicated an abundance of suspended food. An abundant canal nekton was represented by about thirty species, the principal source of fish being an escapement from the Fish Collection Facilities at the canal intake. Algae was not significant, probably because of high turbidity and related light deficiency. The amphipoda-mud coating on canal side lining consisted of Corophium spinicorne Stimpson. Three species of fresh-water sponges were identified, varying in amounts from year to year. In bottom sediments the most prominent and abundant species was the Asiatic clam, Corbicula fluminea, and sizes and amounts were measured each year. Amounts tend to decline in the downstream. Only very small amounts of other organisms were noted. (See also W71-12029) (Smith-PAI)
W71-13260

FOOD FROM THE SEA: BRIGHT HOPE OR ILLUSION.,
Florida Dept. of Natural Resources, Tallahassee. Marine Research Lab.
R. M. Ingle.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970. Miami Beach, Florida, p 206-210.

Descriptors: *Fish farming, *Oceans, *Commercial fish, Fisheries, Research and development, Cultivation, Fish reproduction, Food abundance, Productivity, Natural resources.

The difficulties of harvesting the oceans for food are exemplified by some of the species which are already being produced by mariculture. Oyster production has required scientific studies and new hatchery methods to maintain supplies. The Japanese have developed an effective raft culture of oysters but in Florida this system has encouraged other animals which crowd out the oysters. Investigations of increased shrimp and pompano production are also going on. Trout and catfish are being produced in large quantities by artificial and controlled methods. Much is to be learned by studying methods used in other countries with alien species which may be adapted to a more local habitat. Many species in the ocean cannot now be harvested or only occur in thinly distributed quantities but exploratory operations have shown that the black sea bass, occurring in large populations off the west coast of Florida, is a potential source of supply. Supplies of hard shell clams have also been discovered but will require new fishing methods and equipment, against the strong opposition of conservative commercial fishermen. The importance of aquatic farming as a source of food will require educational and policy making efforts to overcome inefficient and outmoded methods and ideas. (See also W71-12029) (Smith-PAI)
W71-13261

MEASURING THE INFLUENCE OF WATER-QUALITY CHANGES ON FISH,
California, Univ., Davis. Dept. of Animal Physiology; and Geological Survey, Washington, D.C.
R. C. Averett, and R. W. Brocksen.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970. Miami Beach, Florida, p 212-222. 3 fig, 1 tab, 29 ref. WP01487-01.

Descriptors: *Animal physiology, *Environmental effects, *Water quality, Fish, Temperature, Saline water, Growth rates, Productivity, Respiration, Testing, Measurement, Toxicity, California.
Identifiers: Salton Sea (Calif).

The influence of environmental changes on aquatic life are being studied and the physiological stress determined. The technique of toxicity bioassays has been frequently used to discover the median tolerance of test animals to waste concentration or environmental change, and to lethal temperatures. The swimming performance of fish as a measure of sublethal stress has also been studied. More valuable is work which has been done on energy and material utilization by fish, from the point of view of growth and its related processes. An experiment on juvenile coho salmon is used to illustrate the influence of temperature on growth and standard metabolism. Graphs show consumption-growth curves at different temperatures, and standard metabolic rates. Experiments were also done on the influence of varying salinities on growth, food assimilation and respiration of young corvina from the Salton Sea, California, and results are discussed and illustrated by graphs. Food assimilation was highest at the medium 37ppt salinity, growth occurred at all salinity levels but more food was required for maintenance needs at the extremes of 29 and 45ppt salinities. Oxygen uptake was also highest at the two extreme levels. Energy-demanding processes and other stress factors might also be tested, but growth is the single best measure of the influence of water-quality changes. (See also W71-12029) (Smith-PAI)
W71-13262

THE PRESENT RELATIONSHIP BETWEEN WATER-RESOURCES PROBLEMS AND CONTROLLED CULTURE OF MARINE AND FRESH-WATER ANIMALS,
Aquatic Sciences, Inc., Boca Raton, Fla.
F. A. Kalber.
In: Symposium on Hydrobiology, 'Bioresources c shallow water environments', June 24-27, 1970 Miami Beach, Florida, p 223-225.

Descriptors: *Water requirements, *Conservation *Fish farming, Water resources development, Water reuse, Fish management, Cultivation, Aquatic productivity, Ecology.

The themes of reason, requirements and conservation are related to water-resource problems. It appears that reason has so far been applied insufficiently to the protection of water reserves, though present-day public and private awareness of the value of water may ensure more rational planning in the future. However, more technical data and

faster action are required to keep up with the constantly changing problems. The requirements of present and future water usage in relation to environmental preservation must be established. The conservation principle defined as 'intelligent use of a natural resource' must be applied by water management to the problem of the relationship between water-resource problems and controlled culture of aquatic animals. In countries where food and water shortages have occurred there is a historic background of water reuse, or the utilization of one source for several purposes, such as fish raising in rice paddies, irrigation ditches and reservoirs. Modern technology can be applied to the same end, such as putting aquatic eutrophication together with controlled fish culture, but water management experts must work closely with fisheries technologists to achieve the common ideals of food production and water conservation. (See also W71-12029) (Smith-PAI)
W71-13263

MARINE LARVAE - THE NEGLECTED LINK IN BIOLOGICAL RESOURCES,
Duke Univ., Beaufort, N.C. Marine Lab.
J. D. Costlow, Jr., and C. G. Bookhout.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970. Miami Beach, Florida, p 228-236. 18 ref.

Descriptors: *Marine animals, *Larvae, *Environmental effects, Natural resources, Food chains, Larval growth stage, Distribution patterns, Salinity, Temperature, Animal physiology, Laboratory tests.
Identifiers: Crab larvae.

Marine larvae, found in most estuaries and marine environments, are responsible for maintaining existing populations, for distribution of the species and for introduction into new environments. The Brachyura or crab larvae are studied. Much information is available on distribution, abundance, seasonal variations, and the dependence of certain crab species upon larvae in particular regions, but more accurate identification of the individual larval stages is needed. Techniques for culture and study of larvae in the laboratory are increasing knowledge of larval stages, and under controlled conditions environmental factors can be studied. The effects of varying temperatures and salinities are demonstrated by tests on four distinctly different crab larvae: the small mud crab, Rhithropanopeus harrisii; the edible stone crab, Menippe mercenaria; the land crab, Cardisoma guanhumi; and the common edible blue crab, Callinectes sapidus. Effects of regular cyclic changes in temperature and salinity on marine Crustacea were also studied, and the evidence applied to distribution patterns of certain species. The knowledge gained may be applicable to development of techniques for culture operations, and to the effects of chemical pollutants such as DDT residues. Much more work remains to be done on this neglected link of the marine food chain. (See also W71-12029) (Smith-PAI)
W71-13264

MARINE BIORESOURCES - DEPENDENCE UPON ENVIRONMENTAL QUALITY,
Environmental Research and Applications, Inc.
R. J. Benoit.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970. Miami Beach, Florida, p 240-246, 21 ref.

Descriptors: *Estuaries, *Marine animals, *Environmental effects, Water resources, Food chains, Eutrophication, Water pollution, Landfills, Commercial fish, Shellfish, Water quality acts, Connecticut.
Identifiers: Bay scallops.

Marine bioresources are defined as the valuable living things that spend part or all of their lives in oceans, bays and estuaries, right down to the vegetation which provides the original detritus in the marine food chain. Estuarine species are declining in certain areas, probably because of man's activities. An example of this is the virtual disappearance of the bay scallop from Connecticut waters because of the filling of tidal marshes. In 1969 the Connecticut General Assembly passed an act to preserve the wetlands and tidal marsh and estuarine systems. Coastal regions fisheries are critically dependent upon estuarine conditions for the continued production of fish. Ecologists believe that biotic diversity is the best measure of environment quality. Various techniques of measurement, including toxicity bioassay, can be used. Water pollution effects on scallops are being tested in the Niantic River estuary. Estuaries come in a great variety of physiographic types, but the main ecological controlling factors are net flow of resh water, volume of the basin, and tidal volume exchanged at each cycle. In the Niantic River estuary, nitrogenous waste substance may be a critical cause of the failure of the bay scallop because of excessive eutrophication. This is only one example of the effects of environmental imprudence. (See also W71-12029) (Smith-PAI)
W71-13265

OPTICAL REMOTE SENSING OF BIORESOURCES,
Grumman Aerospace Corp., Bethpage, N.Y.
W. G. Egan.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970. Miami Beach, Florida, p 303-316. 7 fig, 14 ref.

Descriptors: *Remote sensing, *Water resources, *Photography, Electronic equipment, Instrumentation, Biological properties, Data collections, Data processing, Optical properties, Terrain analysis.
Identifiers: Timber Island, *Bioresources.

Optical remote sensing for observation of the bioresources of shallow water environments can be used when the optical absorption of the scattered radiation by the atmosphere is not too great. Timber Island, at the mouth of the Connecticut River, south of Long Island, is used as an example of how the optical properties of bioresources are determined. Infrared photographs and analyses of vegetation are shown. Reflectances vary for each variety of flora. Water flow lines, shallow water areas and bottom flora are also indicated. Stokes parameters are used to describe optical properties in the scattered radiation. Optical remote-sensing techniques for the determination of the Stokes parameters can be photographic, using a camera, and electronic, using a scanner. The development and use of both techniques are described. The large amounts of data obtained must be transformed into useful information, usually by automatic processing. Analysis of the data obtained on Timber Island is used as an example. Conversion of the technology to a precise information-gathering means from a highly variable biological environment is difficult but progress is being made. (See also W71-12029) (Smith-PAI)
W71-13266

SAMPLING THE BENTHOS,
Toronto Univ. (Ontario). Dept. of Zoology.
R. O. Brinkhurst.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970. Miami Beach, Florida, p 351-355. 1 fig, 2 ref.

Descriptors: *Sampling, *Benthos, Hydrologic data, Cores, Data collections, Sediment, Aquatic life, Equipment, *Tools.
Identifiers: Kajak corer.

Samplers must conform to certain specifications: depth of penetration is required from the surface to at least 20 cm; the bite should be such that all depths are sampled equally; complete closure of the mechanism is needed to retain all of the sample; no pressure waves from the sampler's descent must occur to cause sediment disturbance. Requirements for quantitative studies are that the samples produced must be either relative quantitative samples, taken in different places by one sampler, or absolute quantitative samples which require very fine screening and residue sorting with a stereomicroscope. No single sampler is likely to answer all of these requirements, but the closest is the Kajak corer which can take nine cores simultaneously, creates no internal pressure, and provides cyclindrical samples of constant cross-sectional area from top to bottom. Other samplers available are described and are almost all modified versions of two classical tools, the Peterson and the Ekman. Sampling tools and number of samples taken at each station must be carefully determined in relation to types of organisms under study and nature of the sediment. (See also W71-12029) (Smith-PAI)
W71-13267

ADVANCED ANALYTICAL METHODS FOR INVESTIGATING AQUATIC ENVIRONMENTS,
Missouri Univ., Rolla. Dept. of Environmental Health.
B. G. Wixson.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970. Miami Beach, Florida, p 357-364. 4 fig, 1 tab, 11 ref.

Descriptors: *Analytical techniques, *Aquatic environment, *Water pollution effects, Mine wastes, Mills, Fish, Benthos, Spectroscopy, Photometry, Instrumentation, Waste water treatment.
Identifiers: New Lead Belt, Missouri.

The New Lead Belt in Viburnum, Missouri, is a rich belt of lead-zinc ore. Advanced analytical methods have been necessary to determine pollutants resulting from the mining and milling operations, and possible abatement methods. The unusual topography of the Viburnum Trend has resulted in a unique drainage pattern of streams which is shown, together with location of mines, settling lagoons and sampling sites. Four mines and mills were in production by 1970 and studies of the area should indicate future environmental changes which additional mines will cause. Mining waste waters were evaluated for pH changes, dissolved oxygen deficiencies, temperature shifts, and other changes in water quality harmful to aquatic life. Research techniques were developed for detecting specific compounds or decomposition products. Photometric methods were employed to detect organic chemicals used in the flotation process for extracting lead, zinc and copper concentrates. Heavy metals were determined by atomic absorption spectroscopy. Responses of different biotic organisms to changes in aquatic environment were evaluated and toxicity studies on blue gill sunfish were made. Results of the studies are discussed and recommendations for stream pollution abatement are made. The need for continued research on new techniques and instrumentation is stressed. (See also W71-12029) (Smith-PAI)
W71-13268

APPLICATIONS OF THE HORTON STREAM CLASSIFICATION TO EVALUATE FAUNAL STUDIES,
Kentucky Univ., Lexington. Dept. of Zoology.
R. A. Kuehne.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970. Miami Beach, Florida, p 367-370. 1 tab, 18 ref.

Descriptors: *Evaluation, *Streams, *Systematics, Theoretical analysis, Fauna, Aquatic environment, Lotic environment, Water pollution sources.
Identifiers: Horton stream classification.

The Horton stream classification is suggested as an integrative framework for lotic studies and could be very useful to aquatic biologists. This classification of streams has been mostly used in studies of watershed geomorphology. It is based on the observation that streams consistently bifurcate in such a way that they can be ranked numerically. As an illustration, headwater tributaries with no an-

tecedents are designated first order, and the world's largest rivers are tenth order. Streams have great differences in many characteristics, but have amazing consistency in regard to certain parameters, such as relationship between order, number, length and drainage area. Using the Horton system as a model, an investigator can consider a stream as a segment of a linear sequence, or view particular streams as master units, or consider a basin as a single ecosystem. Examples of the application of this classification system are given. Not all attempts have been successful but the system offers great possibilities for theoretical comparative studies and for the objective evaluation of various forms of stream pollution. (See also W71-12029) (Smith-PAI)
W71-13269

ABUNDANCE OF MARINE PHYTOPLANKTON IN SURFACE FILMS: A METHOD OF SAMPLING,
Virginia Inst. of Marine Science, Gloucester Point.
V. M. Roy, J. L. Dupuy, W. G. MacIntyre, and W. Harrison.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970. Miami Beach, Florida, p 371-379. 3 fig, 2 tab, 12 ref. FWQA 15080EJ0.

Descriptors: *Sampling, *Phytoplankton, *Surface waters, Data collections, Cytological studies, Comparative productivity, Oily water, Estuarine environment, Subsurface investigations, Equipment.

Existing methods for surface microlayer collection and their suitability for phytoplankton collection are discussed. The density of phytoplankton populations in normal estuarine environments was compared with that of populations in adjacent areas covered by an oil slick. Relative abundance of phytoplankton at the surface and at one meter depth was also examined. Sampling devices used for surface collections were a modified rotating drum and a screen apparatus, and their performances were evaluated. Subsurface collections were taken with a one-liter Frautschy bottle. Samples were collected from the York River and Chesapeake Bay from August, 1969, to June, 1970. Weather and temperature conditions were observed and salinity samples taken. Methods used for quantitative comparisons of surface and one-meter collections are described. Field samples were concentrated and phytoplankton cells were identified and enumerated quantitatively by the Utermohl method. Slick and non-slick samples were compared for significant differences. Counts taken with the screen showed a greater concentration of cells in the non-slick samples and at the surface. Comparative drum samples failed to show such a pattern. Possible reasons for this are suggested and a new drum sampler is being constructed as this method is best for large-scale investigations. Further documentation is needed to achieve firmer conclusions. (See also W71-12029) (Smith-PAI)
W71-13270

MODELS OF AQUATIC ENVIRONMENT BIOASSAY,
Aquatic Sciences, Inc., Boca Raton, Fla.
V. C. Goldizen, and W. P. Davis.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970. Miami Beach, Florida, p 381-385. 3 ref.

Descriptors: *Bioassay, *Aquatic environment, *Model studies, Sampling, Laboratory tests, Water pollution effects, Quality control, Probability, Warning systems, Forecasting, Hydrologic data.

The effects of pollutants on aquatic organisms is a very rapidly growing research field, but so far studies have only been made after biological catastrophies have occurred. Systems must be developed for predicting and preventing them. Various possibilities for early warning systems are discussed. Chemical sensors have limited application in the total ecosystem but could best be used by chemical industries needing biological information and wishing to monitor and clean their effluents. Industrial monitoring requires sensing of physical parameters which can be analyzed and used to predict potential problems such as oil spillages in well defined environmental systems. Environmental biological monitoring systems would give combination measurements of short-term effects and accumulate long-term information. Field information and laboratory data must be incorporated into monitoring systems design. Aquatic monitoring systems can be developed in four phases, namely, field studies, test organism, test configurations, and system components. Close coordination between all agencies and institutions engaged in environmental studies is essential. A self-supporting monitoring system in an area such as the Everglades is projected as an example of how such a system might work. The goal is a system incorporating remote data sampling with controlled culture devices to produce a realistic monitor of environmental events and trends. (See also W71-12029) (Smith-PAI)
W71-13271

REMOVAL OF PHOSPHOROUS FROM A SEWAGE LAGOON BY HARVESTING ALGA,
Mississippi State Univ., State College, Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
W71-13313

STUDIES OF PHOSPHORUS COAGULATION AND PRECIPITATION USING IRON SALTS FOR APPLICATION IN WASTE WATER TREATMENT,
Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 05D.
W71-13317

PHOSPHOROUS EXTRACTION FROM SOLUTION BY HETEROGENOUS BIOLOGICAL SYSTEMS,
Maine Univ., Orono, Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
W71-13334

THE MECHANISM OF PHOSPHOROUS REMOVAL IN ACTIVATED SLUDGE,
Maine Univ., Orono. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
W71-13335

MAXIMUM PERMISSIBLE CONCENTRATION OF DIPROPYLAMINE IN WATER BODIES,
Sanitarno-Gigienicheskii Meditsinskii Institut, Leningrad (USSR).
E. V. Teplyakova, S. N. Zyabbarova, M. N. Kuklina, and E. N. Pashkina.
Hygiene and Sanitation, Vol 35, No 4, April 1970. p 127-128.

Descriptors: *Chemical wastes, *Toxicity, Organoleptic properties, Odor, Taste, Color, Public health, Laboratory tests, Industrial wastes, Water quality control, Water pollution effects.
Identifiers: *USSR, *Dipropylamine.

Dipropylamine is a clear liquid with an ammonaical odor, having an olfactory threshold in water of 0.89 plus or minus 0.038 mg/l, and a gustatory threshold of 0.63 plus or minus 0.054 mg/l. Concentrations of dipropylamine in the .05- 0.5 mg/l range had no significant effect on BOD dynamics, while some inhibition of the first phase of nitrification occurred at 10 mg/l and pronounced inhibition of the development of aquatic saprophytic macro-flora occurred between 20 and 30 mg/l. Short term testing established LD50 of 280 and 320 mg/kg for albino rats and white mice, with no significantly detectable cumulative effects. A 6 month study was also performed on 60 albino rats and 24 rabbits. The animals were poisoned perorally by administering dipropylamine in the drinking water in doses of 0.02, 0.2 and 5 mg/kg. Results indicated that doses of 0.02 mg/kg had no effect on warm-blooded animals. Therefore the threshold concentration was based on the organoleptic criterion, at 0.5 mg/l. (Lowry-Texas)
W71-13339

PROPOSED PURCHASE OF ZECTRAN FOR USE IN MANAGING POPULATIONS OF SPRUCE BUDWORM AND JACK-PINE BUDWORM IN THE UNITED STATES.
Forest Service, Washington, D.C.

Available from NTIS as PB-198 907F, $3.00 in paper copy, $0.95 in microfiche. Final environmental impact statement, 7 May 71. 34 p.

Descriptors: *Environmental effects, *Insecticides, *Forests, *Ecology, Insects, Pine trees, Environment, Toxicity, Aquatic animals, Birds, Animal parasites, Lava, Pesticides, Wildlife, Soils, Jack pine trees.
Identifiers: *Environmental impact statements, Zactran, *Spruce, *Budworms.

Outbreaks of the spruce budworm and Jack-pine budworm adversely affect recreation, esthetics, and timber production in the western and eastern United States. Currently, these defoliators are reported to be causing noticeable damage to 5.7 million acres of spruce-fir forest. Zectran is a nonpersistent insecticide that is highly toxic to the spruce budworm and Jack-pine budworm. Birds, bees, and freshwater shrimp have also shown a high degree of susceptibility to Zectran. Aquatic insects are affected, but their populations recover. Zectran is suspected of being tumorigenic. Fish, bullfrogs, and parasites of the spruce budworm show tolerance to the chemical. Zectran is recommended for control of western and eastern spruce budworm and the jack pine budworm by means of an aerial application of 0.15 pound technical Zectran per gallon per acre. Formulation consists of a glycol other concentrate of Zectran diluted with 9 volumes of deodorized kerosene.
W71-13373

INHIBITION OF ANIMAL TISSUE ATPASE ACTIVITIES BY CHLORINATED HYDROCARBON PESTICIDES,
Honeywell Inc., Hopkins, Minn. Corporate Research Center.
R. B. Koch.
Available from the National Technical Information Service as AD-723 624, $3.00 in paper copy, $0.95 in microfiche.

Descriptors: *DDT, *Chlorinated hydrocarbon pesticides, *Pesticides, Inhibition, Enzymes.
Identifiers: Adenosine phosphates, Sensitivity, Aordane, Lindane, Kelthane.

The 4 chlorinated hydrocarbon pesticides--chlordane, lindane, DDT and dicofol (Kelthane)--tested on tissue homogenates inhibited both the Na.. -K.. ATPase and Mg2.. ATPase enzyme systems. Discrete fractions were obtained by differential and density-gradient centrifugation of tissue homogenates from rabbits, chickens, lake trout, and cockroaches; they included red blood cells, brain, olfactory, kidney, heart, liver and muscle. At low concentrations DDT was the most effective inhibitor of the Mg2.. ATPase. At higher concentrations, Kelthane produced the greatest inhibition of both ATPase activities. Chlordane and lindane also inhibited both ATPases with the former being the more effective. Red blood cell 'ghosts' (plasma membranes) differed from other tissues in that its Na.. -K.. ATPase activity was insensitive to the insecticides, except for a slight effect from Kelthane. The Mg2.. ATPase activity of a muscle fraction B from different sources was significantly more affected by the pesticides than that of a liver fraction B.
W71-13374

UNDERSTANDING THE DYNAMIC BEHAVIOR OF RADIONUCLIDES RELEASED TO THE ENVIRONMENT AND IMPLICATIONS,
Oak Ridge National Lab., Tenn.
S. I. Auerbach, S. V. Kaye, D. J. Nelson, D. E. Reichle, and P. B. Dunaway.
Available from Unipub, Inc. P.O. Box 433, New York, N.Y. 10016. In: Fourth United Nations International Conference on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, September 6-16, 1971, p 3.3-3--3.3-18. 3 fig, 35 ref.

Descriptors: *Radioactivity effects, *Environmental effects, *Path of pollutants, Nuclear wastes, Public health, Food chains, Food webs, Growth stages, Radioecology, Radioisotopes, Forests, Habitats, On-site investigations, Systems analysis, Clams, Monitoring, Absorption, Sediments, Water pollution sources, Soil-water-plant relationships.
Identifiers: Radionuclide uptake.

A substantial effort is needed to supply information about future radionuclide effects on ecological systems. Further integration and interpretation of concentration factor data is needed (with regard to species, habitat, and regional bases). Systems-analysis techniques have the potential for comprehensive radiological assessment. Usually concentration factors decrease at higher levels in aquatic food chains, but scandium and cesium may concentrate in terrestrial vertebrates. Radionuclides which may deliver significant doses to man include those from fission (Sr, Ru, I, Cs, Kr, and Xe), from neutron activation (Na, P, Mn, W, Pb, and Hg), and from nuclear fuels (Pu, U, and Am). The filtering mechanism of clams enables uptake of radionuclides adsorbed on sediment; and since the radionuclides in the shells are not subject to replacement, the growth rings in the shells are integrating indicators of certain low level environmental radionuclides. Developing or transforming stages of animals and progenitive tissues of plants are particularly vulnerable to ionizing radiation. (Bopp-NSIC)
W71-13376

BIO-MEDICAL DIVISION PRELIMINARY REPORT FOR PROJECT SCHOONER,
California Univ., Livermore. Lawrence Radiation Lab.
For primary bibliographic entry see Field 05B.
W71-13379

STUDY OF THE PARAMETERS OF RADIOCOBALT TRANSFER IN CONTINENTAL AQUATIC AND IRRIGATED ECOSYSTEMS,
Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
Robert Bittel, Margaret Merlini, Constant Myttenaere, and Oscar Ravera.
Available from NTIS as CEA-R-4157, $3.00 in paper copy, $0.95 in microfiche. Report CEA-R-4157, March 1971. 36 p, 20 tab, 14 ref.

Descriptors: *Cobalt radioisotopes, *Nuclear wastes, *Food chains, Ecosystems, Marine fish, Mollusks, Sprinkler irrigation, Irrigation effects, Soil-water-plant relationships, Rice, Vegetable crops, Water pollution effects, Reviews, Foreign research, Absorption, Physicochemical properties, Public health, Toxicity.

This progress review covers experimental work on transfer of cobalt radioisotopes from the environment to the food chain; and includes contamination of sea food, of ecosystems through irrigation water, and of vegetables directly by sprinkler irrigation. Since cobalt is an element which is essential biologically, it is important to study effects from low concentrations both in nuclear wastes (Co-58 and Co-60), and from stable cobalt in industrial wastes. It was found that uptake by rice was less than by vegetables (directly from sprayed irrigation water) or by sea food. Chelation by natural substances present in the water probably reduced uptake since lower concentration factors were found than certain of the values reported priorly. It is estimated that about 250 pCi per year will be retained in the body of a man from food contaminated by the presence of 1 pCi/kg in irrigation water and in sea water. Areas of research needing further study are outlined: development of a bioindicator of the physicochemical state of cobalt (valence, chelation, etc.); and the effect of the state on contamination by uptake from irrigated soil, from spray irrigation of vegetables, and from sea food. (Bopp-NSIC)
W71-13381

PLANKTON AND NUTRIENT ECOLOGY OF THE COLUMBIA RIVER ESTUARY,
Oregon State Univ., Corvallis.
Lois S. Haertel.
Available from the National Technical Information Service as RLO-1750-75, $3.00 in paper copy, $0.95 in microfiche. Report RLO-1750-75, June 1970. 80 p. Contract AT (45-1)-1750.

Descriptors: *Phytoplankton, *Zooplankton, *Columbia River, *Estuarine environment, Nutrient requirements, Photosynthesis, Phosphates, Ammonium compounds, Regression analysis, Temperature, Salinity, Productivity, Seasonal.

The wide tidal range and the large and varying volume of entering fresh water produce a relatively extreme environment. Monthly samples of nutrients, phytoplankton and zooplankton were taken over a period of 16 months. The phytoplankton are probably light-limited for most of the year. Low nitrate and phosphate levels in late summer would suggest the possibility of nutrient limitation at this time. There is a strong correlation between freshwater zooplankton abundance and river temperature. Factors controlling the abundance of the oligohaline and polyhaline zooplankton groups are less obvious. Regression analysis indicates a strong potential for regeneration of the phosphate necessary for phytoplankton growth by the principal zooplankton species, Eurytemora affinis. This would also suggest a similar importance for ammonia which is also excreted by zooplankton. (Bopp-NSIC)
W71-13382

DIATOMS IN LAKES AND LAKE SEDIMENTS AS AN INDEX TO ENVIRONMENT (PROGRESS REPORT, MAY 1, 1970 TO JANUARY 31, 1971,
Minnesota Univ., Minn.
H. E. Wright, Jr.
Available from the National Technical Information Service as TID-25695, $3.00 in paper copy, $0.95 in microfiche. Report TID-25695, 1971. 20 p, 6 fig, 11 ref. Contract AT (11-1)-2046.

Descriptors: *Diatoms, *Lakes, *Minnesota, Sedimentary structures, Cores, Water pollution effects, Salinity, Chemical properties, Phytoplankton, Nutrient requirements, Eutrophication, Aquatic populations, Aquatic productivity, Distribution patterns, Environmental effects, Environmental gradient, Annual turnover, Physiological ecology, Minnesota.

Projects reported are (1) diatom ecology, (2) a literature survey of ecological and chemical data on diatoms, (3) comparison of diatom assemblages in sediments (short cores) from polluted and unpolluted lakes, and (4) the long range stability of diatom populations by analysis of long cores. An increase in the most abundant diatom species from northeast to southwest Minnesota corresponds to increasing salinity and gradients in other chemical parameters. (Bopp-NSIC)
W71-13383

FRESHWATER VERTEBRATE AND INVERTEBRATE ECOLOGY OF AMCHITKA ISLAND (ANNUAL PROGRESS REPORT, July 1, 1969 - June 30, 1970),
Utah State Univ., Logan.
John M. Neuhold, and William T. Hale.
Available from the National Technical Information Service as BMI-171-133, $3.00 in paper copy, $0.95 in microfiche. Report BMI-171-133, April 1, 1971. 15 p, 2 fig, 3 tab, 7 ref. AT (26-1)-171.

Descriptors: *Freshwater fish, *Sticklebacks, *Alaska, Nuclear explosions, Food chains, Secondary productivity, Food habits, Biomass, Water pollution effects, Nuclear wastes, Computer models, Computer programs, Public health, Radioecology, Ecotypes, Environmental effects.

The study of the freshwater ecosystem is a part of the bioenvironmental program at Amchitka Island, Alaska which was organized to recommend measures to minimize adverse effects from the AEC's test program; and to predict radiological hazards to man's food chain from an inadvertent radioactivity release. More detailed accounts of this year's work are reported in 2 theses and 3 papers. In the freshwater ecosystem of Amchitka the main secondary consumers are two species of fish (Dolly Varden and threespine stickleback) which rely for food primarily on aquatic insects, crustaceans, and zooplankton. A computer program has been devised to include parameters for assessing existing and changing conditions in the freshwater ecosystem. (Bopp-NSIC)
W71-13384

ENVIRONMENTAL RADIATION FROM PRESSURIZED WATER REACTORS,
Westinghouse Electric Corp., Philadelphia, Pa. Environmental Systems Dept.
J. H. Wright.
Journal of the Institution of Nuclear Engineers, Vol 12, p 8-12 (Jan.-Feb. 1971). 5 tab, 12 ref.

Descriptors: *Nuclear wastes, *Nuclear powerplants, *Environmental effects, Radioactivity effects, Tritium, Absorption, Fish, Mollusks, Crustaceans, Water pollution effects, Air pollution effects, Food chains, Public health, On-site investigations, On-site data collections, Estimating, Hazards, Radioactivity, Design data, Technology.
Identifiers: Krypton radioisotopes, Radionuclide uptake.

Although there is no short range problem, management of krypton and tritium should be modified within the next two decades. Even in a region containing multiple nuclear plants on 32 km center-to-center locations, radiation effects are quite negligible. This conclusion is based on extrapolation of design data and operating experience with the Yankee Rowe, Connecticut Yankee, and San Onofre pressurized water reactors. Consideration of the operating data showed that the design data for discharge of radioactivity in liquid effluents should be increased six fold (possibly from activated corrosion products). It was considered that less tritium will be released with zirconium than with stainless steel cladding of fuel. The most probable conditions were used to determine the average exposure to the general population including intake from water and aquatic foods (less than 5% of that from water). (Bopp-NSIC)
W71-13385

ECOLOGICAL ASPECTS OF TRITIUM BEHAVIOR IN THE ENVIRONMENT,
Oak Ridge National Lab., Tenn.
Jerry W. Elwood.
Nuclear Safety, Vol 12, No 4, July-August 1971. p 325-337, 57 ref, 1 tab.

Descriptors: *Tritium, *Nuclear wastes, *Water pollution effects, Absorption, Food chains, Public health, Radioactivity effects, Nuclear powerplants, Nuclear engineering, Environmental effects, Ecotypes, Aquatic life.
Identifiers: Nuclear fuel-reprocessing plants.

The literature is reviewed on tritium in discharges from power reactors and fuel reprocessing plants, and on uptake by plants and animals from water and food. By 1995, nuclear power production will be the predominant source of newly generated triti-

um in the environment; however tritium is dispersed so rapidly that only a small fraction of the maximum permissible concentration is found near reactors. When organisms are exposed to tritiated water (HTO) about ten fold more tritium is found in body water than in tissue. The retention half-life is greater for tissue-bound tritium (as long as 2000 days for the longer component with certain human organs) than for body water (9.5 days). The proportion of tritium retained in body tissue or milk is much greater for uptake from food than from water. Turnover times of tritium and hydrogen do not differ significantly in natural ecosystems, and there is no significant concentration relative to hydrogen in food chains. Turnover times are usually found to be simply related to the turnover time for water both in aquatic and terrestrial ecosystems. (Bopp-NSIC)
W71-13388

OPPORTUNITIES TO MONITOR POTENTIAL DOSE TO MAN FROM NUCLEAR EXCAVATION,
California Univ., Livermore. Lawrence Radiation Lab.
Larry L. Schwartz, William L. Robison, and Lynn R. Anspaugh.
Available from the National Technical Information Service as UCRL-51068, $3.00 in paper copy, $0.95 in microfiche. Report UCRL-51068, June 15, 1971. 20 p, 4 fig, 4 tab.

Descriptors: *Nuclear wastes, *Food chains, *Nuclear explosions, *Excavation, Nuclear engineering, Radioactivity effects, Milk, Foods, Path of pollutants, Water pollution effects, Fallout, Precipitation (Atmospheric), Background radiation, Water pollution control, Air pollution effects, Iodine radioisotopes, Public health, Monitoring.
Identifiers: Critical nuclide pathway, Surface water, Nuclide occurrence, Dose calculation, Internal survey, Environment, Monitor, Environmental.

As the distance from a nuclear shot increases, other pathways of exposure become relatively more important in comparison to external gamma radiation. The extent of radiation monitoring surveillance may range from verification of the shot-time meteorology and the vented fraction to documentation of all significant radionuclides through all pathways to man - depending on the radionuclide source, the population at risk, the critical pathways, and the degree of availability of documentation of similar events. The radioactivity of milk is a valuable means of assessing environmental contamination since it represents a large consumption of vegetation during grazing. Assaying of vegetation and water is also desireable. The radioactivity of animal organs (thyroid glands, bone, liver, and kidneys) is a sensitive method of monitoring many critical nuclides. (Bopp-NSIC)
W71-13389

HEALTH PHYSICS ASPECTS OF NUCLEAR FACILITY SITING SUMMARY OF CONFERENCE NO. 701106,
Health Physics Society.
P. G. Voilleque, and B. R. Baldwin.
Available from Burton R. Baldwin, Publications Chairman, P.O. Box 2431, Idaho Falls, Idaho 83401. Three vols-Price $13.00. CONF. 701106, 3 volumes, Proceedings Fifth Annual Health Physics Society, Midyear Topical Symposium, Health Physics Aspects of Nuclear Facility Siting, Idaho Falls, Idaho, Nov 3-6, 1970.

Descriptors: *Nuclear power plants, *Electric power plants, *Sites, *Environmental effects, *Effluents, *Soil contamination, *Water pollution, Water pollution effects, Ecology, Food chain, Absorption, Standards, Fuels, Cooling water, Thermal pollution.
Identifiers: Nuclear power plants, Radioactivity effects.

The purpose of the Symposium was to summarize experience in the field and to provide a forum for its more controversial aspects. Papers on its socio-economic as well as its purely technical aspects were included. It was hoped that the proceedings would serve as a reference for those who are working or interested in the siting of nuclear facilities. The Conference covered such timely subjects as the following, which consisted of a total of 52 papers: I. Facility Siting - Points of View. II. Site Selection. III. Special Siting Evaluations. IV. Fuel, Coolant, and Fission Product Interaction. V. Environmental Impact of Fuel Reprocessing Plants. VI. Evaluation of Environmental Contamination. VII. Environmental Impact of Nuclear Power Plants. VIII. Behavior of Airborne Radioactivity. IX. Radionuclides in Biological Systems. X. Direct Radiation from Clouds. XI. Internal Contamination - Comparing Hazards. XII. Guides, Standards, and Limits. XIII. Facing a Concerned Public. (See also W71-13391 thru W71-13402) (Houser-NSIC)
W71-13390

AN ESTIMATE OF RADIATION DOSES RECEIVED BY INDIVIDUALS LIVING IN THE VICINITY OF A NUCLEAR FUEL REPROCESSING PLANT IN 1968,
Bureau of Radiological Health, Winchester, Mass. Northeastern Radiological Health Lab.
B. Shleien.
In: Proceedings Fifth Annual Health Physics Society Midyear Topical Symposium. Health Physics Aspects of Nuclear Facility Siting, Vol I, Nov 3-6, 1970. p 226-240.

Descriptors: *Water pollution effects, *Effluents, *Water pollution sources, *Nuclear power plant, *Fuels, Nuclear energy, Environment, Food chains, Fish, Deer, Milk, Water, Digestion, Fallout, Radioecology, Aquatic environment, Strontium, Cesium.
Identifiers: Fuel reprocessing, Drinking water, Ingestion (Biological).

This report attempts, by use of the dose commitment concept and surveillance data previously collected, to estimate radiation doses in 1968 to persons in the vicinity of a fuel reprocessing plant from ingestion and inhalation. The dose commitment accrued in 1968 to a hypothetical 'typical individual' is not thought to differ significantly from that for the 'typical individual' in the rest of New York State and is attributable essentially to fallout. This commitment was 77 millirem from strontium-90 to the bone and 1.7 millirem whole body from cesium-137 delivered over a 50-year period. For the hypothetical 'maximum individual' the dose commitment to the bone from strontium-90 is 532 millirem and the first-year dose following ingestion is 38 millirem. The whole-body dose from ingestion of cesium-137 and cesium-134 (mostly from deer meat) is 257 millirem. Preliminary data indicate that the external gamma dose above natural background is approximately 1.2 millirem per year to the 'maximum individual.' Estimated doses from tritium and krypton-85 were negligible (approximately 2 millirem/year). (See also W71-13390) (Houser-NSIC)
W71-13391

PUBLIC HEALTH ASPECTS OF I-129 FROM THE NUCLEAR POWER INDUSTRY,
Bureau of Radiological Health, Rockville, Md; and Iowa State Univ., Ames. Dept. of Chemistry.
J. L. Russell, and P. B. Hahn.
In: Proceedings Fifth Annual Health Physics Society, Midyear Topical Symposium; Health Physics Aspects of Nuclear Facility Siting, Vol 1, Nov 3-6, 1970. p 241-251.

Descriptors: *Nuclear power plants, *Fuels, *Effluents, *Iodine, *Air pollution, *Water pollution, *Water pollution sources, Operations, Discharge measurement, Pollutant identification, Contamination, Human population, Food chain, Environment.
Identifiers: Exposure, Fuel reprocessing, Population exposure, Thyroid.

The production of Iodine-129 in nuclear power reactors and its subsequent release to the environment during fuel reprocessing represents a potential long-term public health problem. Due to its extremely long half-life, any discharged Iodine-129 is essentially a permanent contaminant in the biosphere, where it will eventually be found as a fraction of total iodine within a locality and possibly more widespread. This potential problem, its possible geographical scope, and the projected impact on population exposure are discussed along with data from measurements at nuclear power reactors and a fuel reprocessing plant. A concentration of 0.86% Iodine-129 in total iodine produces the dose limit recommended by the FRC for a suitable sample of an exposed population. The quantity of Iodine-129 discharged from operating power reactors was estimated from measurements of Iodine-131 discharges by calculating an Iodine-129/Iodine-131 buildup ratio. This analysis showed the Iodine-129 discharge from operating power reactors was negligible. Measurements at a fuel reprocessing plant indicated that approximately 10% of the total Iodine-129 inventory in spent fuel was discharged from the stack during the batch dissolution process. The liquid discharge concentrations were about 2% of the total Iodine-129 inventory. Iodine-129 levels in deer thyroids taken in the reprocessing plant locality were about 40% of levels of Federal Radiation Council guidance for human thyroids. (See also W71-13390) (Houser-NSIC)
W71-13392

AN ECOLOGICAL APPROACH TO ENVIRONMENTAL SURVEILLANCE,
Florida Univ., Gainsville.
W. E. Bolch, J. F. Gamble, C. E. Roessler, W. E. Carr, and J. L. Fox.
In: Proceedings of the Fifth Annual Health Physics Society Midyear Topical Symposium, 'Health Physics Aspects of Nuclear Facility Siting', Vol 2, Nov 3-6, 1970. p 252-265, 8 fig, 7 ref.

Descriptors: *Nuclear wastes, *Nuclear powerplants, *Environmental effects, Radioactivity effects, Control, Water pollution control, Aquatic life, Absorption, Tritium, Strontium radioisotopes, Food chains, Sampling, Salt marshes, Estuarine environment, Ecosystems, Ecological distribution, On-site investigations, On-site data collections, Salinity, Heat budget, Thermal stratification, Monitoring.
Identifiers: Monitor, Environmental, Survey, Environment, Environmental control measure, Cesium radioisotopes, Spectrometry, Gamma.

Marine, marshland, and terrestrial ecosystems near the Crystal River Nuclear Plant will be well-studied by the time the plant goes operational. A final objective is to provide recommendations to minimize environmental degradation in the design and operation of powerplants and to provide consultation with the Florida Power Corporation to assist in determining practicable solutions in this area. The first round of sampling (water, sediment, plankton, algae, grasses, oysters, shrimp, crabs, pinfish) in the marine environment included three areas designated by their proximity to the discharge canal and by the flow of the Gulf. Gamma scans, food webs, and environmental stresses (oxygen, salinity, and health of organisms) were studied. Sampling of terrestrial and marshland ecosystems was begun, and a model of radio-cesium cycling was tested. Substantial loss of the fallout radiocesium inventory of plants was found in the fruits (in berries, pine cones, and acorns; but not in palm fronds). Methods of surveillance of radiostrontium and tritium are being developed. (See also W71-13390) (Bopp-NSIC)
W71-13393

QUANTITATIVE EVALUATION OF ENVIRONMENTAL FACTORS AFFECTING POPULATION EXPOSURE NEAR HANFORD,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Lab.
J. F. Honstead.

In: CONF 701106, Proceedings Fifth Annual Health Physics Society Midyear Topical Symposium; Health Physics Aspects of Nuclear Facility Siting, Vol II, p 266-277, Nov 3-6, 1970. Idaho Falls, Idaho.

Descriptors: *Environment, *Evaluation, *Nuclear power plants, *Effluent, *Population, Transfer, Path of pollutants, Columbia River, Diets, Measurement, Instrumentation, Human population, Environmental effects.
Identifiers: Assay, Population exposure, Contamination, Whole body counter, Concentration.

The environmental evaluations performed at Hanford estimate the annual dose received by people living near the site. The estimated average whole-body dose decreased from 18 mRem per year in 1964 to 5 mRem per year in 1968 as several Hanford production reactors were shut down. Hanford radioactivity reaches populated areas by way of the Columbia River and by transport with and deposition from the atmosphere. The local population is distributed through irrigated rural areas downstream and downwind from Hanford and in downstream communities using the river for sanitary water and recreation. The diet and recreation habits of various population groups have been studied through special surveys and related to the resulting dose received by these people. The special surveys that have been performed at Hanford are discussed in this paper and the effect of some of the findings on dose measurements is illustrated by example. These calculations provide sound bases for evaluating the possible consequences of postulated accidents and also assist in the design of a realistic environmental monitoring program. (See also W71-13390) (Houser-NSIC)
W71-13394

IN SITU MEASUREMENTS OF ENVIRONMENTAL RADIOACTIVITY,
Michigan Univ., Ann Arbor.
D. E. Gelskey, P. Plato, and A. P. Jacobson.
In: CONF-701106. Proceedings Fifth Annual Health Physics Society, Midyear Topical Symposium - Health Physics Aspects of Nuclear Facility Siting, Vol 2, Idaho Falls, Idaho, Nov 3-6, 1970. p 278-288.

Descriptors: Aquatic environment, *Monitoring, *Sediment, *Streams, *Lakes, *Water pollution, Water pollution sources, Nuclear power plants, Effluents, Surveys, Soil contamination, Gamma rays.
Identifiers: Measurement, Regulation, Contamination (Water), Pollutant identification, Pollution abatement, Nuclear waste, Sodium, Iodine, Radioactive waste disposal.

Reports an amphibious gamma radiation detection system designed and constructed to measure rapidly and accurately radioactivity on land and in sediments of lakes and streams surrounding nuclear power plants. The detector is a NaI crystal coupled to a phototube and placed inside a water tight aluminum vessel which can withstand water depths to 1000 feet. The vessel is mounted inside a large rubber tire which, when towed, moves the radiation detector over an area at a constant distance above the surface. The detection system has been operated successfully aboard boats and trucks. It's advantages over more conventional environmental monitoring procedures include: (1) large sediment surface areas can be surveyed for radioactivity in short periods of time, (2) larger environmental samples are observed for radioactivity than could be handled conveniently in laboratories, and (3) immediate readout of the levels and types of radioactivity allows emphasis to be placed on areas showing significant radioactivity. (See also W71-13390) (Houser-NSIC)
W71-13395

STABLE ELEMENT AND RADIONUCLIDE RECONCENTRATION IN AQUATIC ECOSYSTEMS. I. STABLE ELEMENT EFFECTS IN THE EQUILIBRIUM SITUATION,
Bureau of Radiological Health, Rockville, Md. Environmental Health Service.
Harold T. Peterson, Jr.
In: Proceedings of the Fifth Annual Health Physics Society Midyear Topical Symposium, 'Health Physics Aspects of Nuclear Facility Siting', Vol 2, Nov 3-6, 1970. p 289-328, 5 fig, 12 tab, 87 ref.

Descriptors: *Food chains, *Radioactivity effects, *Nuclear wastes, Nuclear powerplants, Aquatic life, Nutrient requirements, Absorption, Physiological ecology, Environmental effects, Control, On-site data collections, On-site investigations, Aquatic environment, Water pollution control, Sampling, Ecological distribution, Path of pollutants.
Identifiers: Model, Biological, Surveillance.

Design of environmental surveillance programs requires knowledge of existing stable concentration in the aquatic environment from the standpoint of their effect on radionuclide uptake in food chains. Also, a pre-operational survey of stable elements in aquatic organisms is useful for estimation of radionuclide uptake. The use of theory should reduce the sampling and analytical effort. Models of radionuclide uptake are reviewed and some of their limitations are discussed. It is concluded that the concept of a regulated metabolic pool of essential elements explains the effects on uptake of stable elements including radionuclide decay products, and some effects from age and size. (See also W71-13390) (Bopp-NSIC)
W71-13396

THE USE OF STABLE ELEMENT CONCENTRATIONS IN THE PRE-OPERATIONAL ENVIRONMENTAL MONITORING,
Michigan Univ., Ann Arbor.
J. C. Golden, Jr., and G. H. Whipple.
In: CONF 701106. Proceedings Fifth Annual Health Physics Society, Midyear Topical Symposium - Health Physics Aspects of Nuclear Facility Siting, Vol 2, Idaho Falls, Idaho, Nov 3-6, 1970. p 329-336.

Descriptors: *Monitoring, *Power system operation, *Operation, *Regulation, *Background radiation, *Path of pollutants, Human population, Food chains, Aquatic environment, Absorption, Bio control.
Identifiers: Pre-operational, Aquatic populations, Fish, Lobsters, Biological communities, Management.

An important aspect of pre-operational monitoring for a nuclear facility is selecting the main pathways by which radioactive materials discharged from the facility may reach human food. The principal factor which determines the degree to which a particular radioactive isotope can be concentrated in foods derived from an aquatic environment is the ratio of the concentration of the stable isotope in the edible portion of the food to that in the water. The premise is that the radioactive isotopes can be biologically reconcentrated only to the same degree as are their stable forms. The objectives of the stable element study are (1) to establish the maximum degree to which the radioactive materials discharged to the water will reconcentrated in human food derived from that water, (2) to identify the limiting food pathways to man, and (3) to select suitable monitor organisms for the radiological monitoring program. A monitor organism is a readily obtainable organism with limited mobility, high concentration factors, and low variability of stable element content from sample to sample. A study of the distribution of stable elements in the environment at a prospective nuclear facility is the best available method for estimating well in advance of operation the potential exposure to man resulting from a release of radioactivity to the hydrosphere. This paper describes such a stable element program for pre-operational environmental monitoring. (See also W71-13390) (Houser-NSIC)
W71-13397

A RECAPITULATION OF EFFLUENT RELEASES AND RELATED CHANGES IN BACKGROUND RADIATION LEVELS AT BROOKHAVEN NATIONAL LABORATORY, AND SOME COMPARISONS WITH THOSE ASSOCIATED WITH NUCLEAR POWER REACTOR PLANTS,
Brookhaven National Lab., Tenn.
A. P. Hull.
In: Proceedings Fifth Annual HEALTH Physics society Midyear Topical Symposium; Health Physics Aspects of Nuclear Facility Siting, Vol II, p 342-360, Nov 3-6, 1970. (Conf. 701106).

Descriptors: *Nuclear power plants, *Radiation, *Effluents, *Fallout, Precipitation (Atmosphere), Radioactive waste disposal, Operations, Data collections, Sites, Tritium, Water pollution sources, Evaluation, Argon, Waste treatment.
Identifiers: Gamma emitter, Beta emitter, Air pollution, Water pollution, Rainout, Nuclear waste, Measurement, Sampling, Background, Brookhaven National Laboratory.

Laboratory operations at Brookhaven since its establishment in 1949 have included the routine release to the environment of gaseous, halogen, air particulate, and 3H radioactivity in reactor air effluents and of beta-gamma emitters and 3H in low-level liquid wastes in amounts comparable to current releases from power reactors. Past and current surveillance data at BNL have been evaluated for short and long-term changes in radiation levels attributable to these operations. The data examined for cumulative deposition of long-lived air effluent nuclides include continuous measurements of external background radiation levels, both on and off site, and measurements of gamma-emitters in soil and vegetation and of 90Sr and 137Cs in milk from close-in and more distant farms. The data examined for the accumulation or uptake of radionuclides contained in liquid effluents include the concentrations and amounts of activity discharged into and released from a sanitary waste treatment facility, average concentrations in water samples from downstream and remote locations, current concentrations of radionuclides in the stream sediments and vegetation, and the current concentrations in samples of water from eleven widely separated on-site supply wells. On the basis of these data, it is concluded that few changes in background should be apparent, even after long term operation of nuclear power reactors. (See also W71-13390) (Houser-NSIC)
W71-13398

RADIOIODINE DISTRIBUTION IN THE TARAPUR POWER REACTOR ENVIRONMENT DURING COMMISSIONING AND INITIAL OPERATIONS,
Tarapur Atomic Power Station (India).
I. S. Bhat, J. Osinsk, S. Chandramouli, and P. R. Kamath.
In: CONF 701106, Proceedings Fifth Annual Health Physics Society Midyear Topical Symp., Health Physics Aspects of Nuclear Facility Siting, Vol II, p 361-371, November 3-6, 1970.

Descriptors: *Nuclear power plants, *Effluents, *Radioisotopes, *Iodine radioisotopes, *Fallout, Measurement, Surface waters, Soil contamination, Radioactive waste, Radioecology, Oceans.
Identifiers: Radioactivity release, Stack, Deposition, Concentration, India, Indian Ocean.

Tarapur Atomic Power Station (TAPS) is located about 100 kms north of Bombay on the west coast of India. The two boiling water reactors of 200 MWe capacity each were commissioned in February 1969 and the commercial operation started in January 1970. During the operation, the Power Station releases low level radioactive wastes containing fission products and activation products. The liquid radioactive wastes are discharged to the sea along with the hot condenser coolant seawaters. The gaseous wastes are released through a 113 m tall stack. It was observed that 70 to 90% of the total activity in the radwaste is due to radioiodines. The radioiodines level in the various environmental samples both from sea and from

deposition on land are given in the paper. (See also W71-13390) (Houser-NSIC)
W71-13399

ACCUMULATION OF RADIOCESIUM IN RAINBOW TROUT VIA A NON-FOODCHAIN PATHWAY,
Colorado State Univ., Fort Collins.
A. F. Gallegos, F. W. Whicker, and T. E. Hakonson.
In: Proceedings of the Fifth Annual Health Physics Society Midyear Topical Symposium, 'Health Physics Aspects of Nuclear Facility Siting', Vol 2, Nov 3-6, 1970. p 477-498, 6 fig, 4 tab, 15 ref.

Descriptors: *Rainbow trout, *Radioisotopes, *Bottom sediments, Lakes, Cesium, Amphipoda, Daphnia, Colorado, Food chains, Food habits, Food webs, Fallout, Lake trout, Lake fisheries, Water pollution effects, Absorption, Radioactivity effects.
Identifiers: Cesium radioisotopes.

It is postulated that uptake of cesium-137 by rainbow trout in East Twin Lake results in large part from bottom sediment, since 0.1 g (dry weight) of sediment could supply the cesium found in the fish while the cesium in the major food organisms (amphipods and daphnia) is insufficient. Furthermore it was found that 60% of the cesium in orally injected sediment was incorporated into the soft tissue of the fish over a 96-hour test period, that sediment minerals were present in trout stomachs, and that ashed amphipod samples contained no mineral residue. Cesium-137 levels in trout from East Twin Lake remained fairly constant during 1966-1969, although levels decreased steadily in trout from other Colorado mountain lakes. (See also W71-13390) (Bopp-NSIC)
W71-13400

PLUTONIUM CONCENTRATION IN ORGANISMS OF THE ATLANTIC OCEAN,
Woods Hole Oceanographic Institution, Mass.
K. M. Wong, J. C. Burke, and V. T. Bowen.
In: CONF. 701106, Preceedings Fifth Annual Health Physics Society, Midyear Topical Symp. Health Physics Aspects of Nuclear Facility Siting, Vol. II, p. 529-539, Nov. 3-6, 1970.

Descriptors: *Environment, *Fallout, *Atlantic Ocean, *Water pollution effects, Marine animals, Marine fish, Marine Microorganism, Analytical technique, Comparative benefits, Aerosols, Sediments, Sea water, Plutonium, Strontium, Cesium.
Identifiers: Concentration, Comparison.

Most environmental studies of radioactive fallout have been focused on strontium 90 and cesium 137 because of their long half-lives and biological significance. Recently, however, plutonium has gained some interest in environmental studies. A SERIES OF MARINE ORGANISMS, COLLECTED ABOUT Cape Cod or in the open N. Atlantic Ocean, have been analyzed for plutonium 239 and for some other fallout radionuclides. These data are compared with those from analyses of marine aerosols, sediments and sea-water. The results show that Pu-239 has been concentrated in some tissues of each organism so far examined. In fish Pu-239 concentrations range from 0.2 to 140 dpm per 100 kg; fresh weight in benthic invertebrates from 23 to 140 dpm per 100 kg; in plankton from 130 to 340 and, in Sargasso weed, to 1280 dpm per 100 kg. Pu-239 ratios to strontium 90 or cesium 137 are higher in organism than in their environment. (See also W71-13390) (Hauser-NSIC)
W71-13401

MANMADE RADIONUCLIDES IN THE HUDSON RIVER ESTUARY,
New York Medical Center, New York. Inst. of Environmental Medicine.
J. W. Lentsch, E. McD. Wrenn, J. Kneip, and M. Eisenbud.
In: CONF 701106, Proceedings Fifth Annual Health Physics Society Midyear Topical Symp. Health Physics Aspects of Nuclear Facility Siting, Vol. II, p. 499-528, Nov. 3-6, 1970.

Descriptors: *Ecology, *Ecosystem, *Environmental effects, *Radioisotopes, *Fallout, Pollutant Identification, Water pollution sources, Reactor power plants, Effluents, Dispersion, Distribution, Deposition (Sediments), Aquatic plants, Cesium, Cobalt, Manganese, Fish, Radioecology, Path of pollutants, Food chain, Hudson River.
Identifiers: Ingestion, Critical nuclide pathway.

As part of a large scale ecological research program, in progress since 1964, we have examined the identity, abundance, and distributions of natural, fallout, and reactor produced radionuclides in the Hudson River estuarine environment. Radionuclides investigated include isotopes of cesium, cobalt, and manganese. The Cs-137 content of fish is in part related to the cumulative diposition in sediments. However, cesium of recent origin appears to be more biologically available. Co-60 accumulates in estuarine sediments with limited, if any, transfer back into aquatic food chains. Mn-54 deposits by sedimentation in the fresh-water regions of the estuary, but leaches from sediments during seasonal salt water intrusions. Sedimentary build-up of Mn-54 is limited by its 303 day half-life. The maintenance of constant stable manganese concentrations by fish during periods of highly variable aqueous manganese concentrations is indicative of regulated uptake and loss of this element. Rooted quatic plants concentrate all of the radionuclides measured except tritium and are useful stationary integrators of aqueous radioactivity levels. The most important radionuclides with respect to exposure of man from reactor releases appear to be Cs-137 and Cs-134, and the critial pathway ingestion of fish. It appears that present regulations restricting the concentrations of radionuclides in cooling water effluents are more than adequate for this aquatic environment. (See also W71-13390) Hauser-NSIC)
W71-13402

METAL TOXICITY TO SEWAGE ORGANISMS,
For primary bibliographic entry see Field 05D.
W71-13404

THE RATE AND EXTENT OF ALGAL DECOMPOSITION IN ANAEROBIC WATERS,
Kentucky Univ., Lexington.
Edward G. Foree, and Perry L. McCarty.
Proceedings, Industrial Waste Conference, 24th, May 6-8, 1969, p 13-36, 13 fig, 8 tab, 9 ref.

Descriptors: *Algae, *Laboratory tests, *Anaerobic conditions, Light intensity, Eutrophication, Nutrients, *Fermentation, Toxicity, Chemical oxygen demand, Hydrogen ion concentration, Temperature, Proteins, Carbohydrates, Lipids, Kinetics, Mathematical models, Neutralization, *Degradation (decomposition), Methane, Water pollution effects.
Identifiers: *Methane fermentation.

Algae cultures decomposing under dark, anaerobic constant temperature conditions were studied in the laboratory to evaluate the effects of cell composition, pH, temperature, and to detect any changes in methane fermentation and sulgate reduction. It was determined that stabilization of algae occurred by sulfate reduction as long as sulfate remained in solution. Once the sulfate supply was exhausted, stabilization continued through methane fermentation. Dark, anaerobic decay of algae was determined as: M— (Mo - fMo) e-kt.. f MO, where f— refractory organic portion having an average value of 0.40 .. 0.15 From 15 to 25C, algal decomposition rate is temperature dependent: k/ko—eck (T-To), with an expected Ck of 0.055/c. Protein, carbohydrate and lipid contents of algae can be reliably calculated as a function of nitrogen content and COD to volatile solids ratio of the cells. (Lowry-Texas)
W71-13413

BIOLOGICAL DENITRIFICATION OF WASTEWATERS BY ADDITION OF ORGANIC MATERIALS,
Stanford Univ., Calif.
For primary bibliographic entry see Field 05D.
W71-13431

URBANIZATION AND SEDIMENTATION - A BIBLIOGRAPHY.
Office of Water Resources Research, Washington, D.C. Water Resources Scientific Information Center.
For primary bibliographic entry see Field 02J.
W71-13432

STREET SALTING - URBAN WATER QUALITY WORKSHOP.
For primary bibliographic entry see Field 05B.
W71-13433

ENVIRONMENTAL IMPACT OF HIGHWAY DEICING,
Environmental Protection Agency, Edison, N.J. Water Quality Lab.
For primary bibliographic entry see Field 05B.
W71-13434

THE EFFECT OF HIGHWAY SALT ON WATER QUALITY IN SELECTED MAINE RIVERS,
Marine Univ., Orono. Dept. of Soil Science.
For primary bibliographic entry see Field 05B.
W71-13435

ROAD SALT AS AN URBAN TRACER,
Lamont-Doherty Geological Observatory, Palisades, N.Y.
For primary bibliographic entry see Field 05B.
W71-13436

EFFECTS OF ROAD SALT ON A VERMONT STREAM,
New England Watershed Research Center, Burlington, Vt.
For primary bibliographic entry see Field 05B.
W71-13438

STREET SALTING AND WATER QUALITY IN MEADOWBROOK, SYRACUSE, NEW YORK,
State Univ. of New York, Syracuse. Coll. of Forestry.
For primary bibliographic entry see Field 05B.
W71-13439

ROAD SALT AS A POLLUTING ELEMENT,
Bureau of Sport Fisheries and Wildlife, Fort Snelling, Minn.
For primary bibliographic entry see Field 05B.
W71-13440

EFFECT OF URBAN SALT RUNOFF ON LAKE STRATIFICATION,
State Univ., of New York Coll. at Oswego. Lake Ontario Environmental Lab.
For primary bibliographic entry see Field 05B.
W71-13441

OCCURRENCE OF PHOSPHORUS AND NITROGEN IN SALT CREEK AT LINCOLN, NEBRASKA,
Geological Survey, Lincoln, Nebr.
For primary bibliographic entry see Field 05B.
W71-13466

TESTING THE TOXICITY OF EFFLUENTS TO FISH,
Water Pollution Research Lab., Stevenage (England).
J. S. Alabaster.

(Water Pollution Research Laboratory Reprint No. 595) Chemistry and Industry, p 759-764, 1970, 6 p, 5 fig, 3 tab, 10 ref.

Descriptors: Test procedures, *Toxicity, *Sewage effluents, *Trout, Water pollution effects, Fish, Effluents, Bioassay.
Identifiers: *Harlequins, *Effluent toxicity, LC-50.

In the appendix to the Ministry of Housing and Local Government Circular No.8/54 it was envisaged that a satisfactory standard test would be developed to measure the toxicity to fish of effluents discharged to rivers. A review of the tests developed to date by the Ministry, the Trent River Authority and the Water Pollution Control Research Laboratory indicates a general correlation of results in some instances. The possibility of unknown substances in samples and variable conditions of such tests renders too close a correlation improbable. The Carter 'rapid bioassay' method of determining toxicity of surface waters to fish is discussed and results using trout and harlequins are compared. A review of test data from various sources indicates that it is unlikely that a single universally applicable fraction of an LC-50 at 48 h. will reliably guarantee the presence of fish in the water sampled. Such a fraction of the LC-50 at 48 h. can be determined for each effluent based on long term laboratory tests coupled with field observations, and it is probable that this fraction will fall within the range of 0.1 and 1.0. (Goessling-Texas)
W71-13537

KENDALL V. SHARP (DAMAGE RESULTING FROM POLLUTION OF STREAM AND GROUNDWATER AS A RESULT OF LUMBER MILL OPERATIONS).
For primary bibliographic entry see Field 06E.
W71-13539

THE ACUTE LETHAL TOXICITY TO RAINBOW TROUT OF MIXTURES OF COPPER, PHENOL, ZINC AND NICKEL,
Water Pollution Research Lab., Stevenage (England).
V. M. Brown, and R. A. Dalton.
Journal of Fish Biology, Vol 2, p 211-216, 1970 , 2 fig, 2 tab, 11 ref. (Water Pollution Research Laboratory Reprint 597).

Descriptors: Water pollution effects, *Toxicity, *Copper, *Phenols, Fishkill, Poison, *Lethal limit, *Rainbow trout, Trout.
Identifiers: *Nickel, *Zinc, Acute toxicity.

In assessing the effects of pollution on fish, consideration must be given to the circumstances in which a number of chemical poisons are present simultaneously. The acute lethal toxicities to rainbow trout, Salmo gairdneri Richardson, of mixtures of copper and phenol, of copper, zinc and phenol, and of copper, zinc and nickel, over an exposure period of 48 hours were determined. Tests were conducted in the laboratory using Perspex aquaria each with 40 liters of solution. The concentrations selected for testing were such that each poison theoretically contributed equally to the toxicity of the mixture. It was found that the toxicities of thee mixtures could be adequately predicted by summation of the fractional toxicities of the particular poisons which were present. (Goessling-Texas)
W71-13540

A REVIEW OF LITERATURE ON INORGANIC NITROGEN METABOLISM IN MICROORGANISMS,
Water Pollution Research Lab., Stevenage (England).
H. A. Painter.
Water Research, Vol 4, p 393-450, 1970. 276 ref.

Descriptors: *Microorganisms, *Metabolism, *Nitrogen compounds, Nitrogen cycle, Inhibition, Growth rates, Nitrogen, Microbiology, *Reviews, *Bibliographies, Water pollution effects.
Identifiers: Autotrophs, Heterotrophs.

All biological growth processes require nitrogen in some form or other for the synthesis of cellular proteins and nucleic acids. Microorganisms can utilize a range of nitrogen compounds for these syntheses. A review of the literature on microbiological changes involving inorganic nitrogen was undertaken and the known essential characteristics of the identifiable processes have been listed. The nutritional requirements, especially for oxygen, of the organisms involved have been described in detail, as have methods for inhibition. Quantitative kinetic and energy data have been included. Suggested pathways and mechanisms are described only where they indicate possible intermediates that can be found in natural habitats. Events involving inorganic nitrogen in purification processes have been described and discussed in light of what is known about various nitrogen transformations considered in isolation. The review revealed a complex situation which can be used only as a guide as to which changes involving nitrogen will occur in a given situation. There are still gaps in the knowledge of the processes. Suggestions are put forward for further investigations. (Goessling-Texas)
W71-13541

KINETIC ASSESSMENT OF ALGAL GROWTH,
California Univ., Berkeley.
E. A. Pearson, E. J. Middlebrooks, M. Tunzi, A. Adinarayana, and P. H. McGauhey.
Chemical Engineering Progress, Symposium Series, Vol 67, No 107, p 5-14, 1971. 8 fig, 5 tab, 9 ref.

Descriptors: Kinetics, *Biological treatment, Plankton, *Eutrophication, *Nutrients, Microorganisms, Effluent, Biochemical oxygen demand, Saturation, Oxygen, Metabolism, Nitrogen, Phosphorous, *Algal control, California.
Identifiers: *Algal growth, *Lake Tahoe (Calif).

It is well known that nutrients such as nitrogen and phosphorus are required for algal metabolism. However, the question remains, is nitrogen or phosphorus usually or frequently limiting the growth rate or standing stock in most receiving waters. To effectively control the rate of eutrophication of our natural waters, this question must be answered. It is not enough to remove nitrogen and phosphorus from wastewaters in hopes of reducing the growth rate or standing stock of plankton in waters concerned. There is an urgent need to develop methods or techniques for assessing the biostimulatory character of waste effluents, natural runoff, etc., estimating the level of consequences one might expect for a given level of rate-limiting nutrient or substance. In no single case is this need more urgent than in the case of Lake Tahoe. Although action to remove sewage effluents from the basin is well underway, human activity in the area is rapidly increasing and it is not known whether other inputs to the Lake should be controlled to limit the rate of eutrophication or enrichment of the Lake. A laboratory method of evaluating the capacity of aquatic environments to grow algae is definitely needed. (Gutierrez-Texas)
W71-13553

TOXIC FACTORS IN ENZYMES USED IN LAUNDRY PRODUCTS,
Rockefeller Univ., New York.
R. Dubos.
Science, Vol 173, No 3993, p 259-260, July 16, 1971. 2 tab, 1 ref.

Descriptors: *Enzymes, *Inhibitors, *Detergents, *Water softening, Animal physiology, Biochemistry, Water pollution sources, Toxins, Toxicity, Water pollution effects, Human pathology.
Identifiers: *Laundry products, *Autolyzates, Bacillus subtillis.

Findings are presented of a study focused on certain bacterial constituents and metabolites which accompany the enzymes in laundry products; biological activities render them potentially dangerous. Tests were carried out with 22 different enzyme preparations, free of detergents. Profound differences observed among the various preparations probably have their origin in the characteristic of the bacterial strains of Bacillus subtilis from which they were prepared. Autolyzates of Bacillus subtilis used as enzymes in laundry products contain several potentially toxic substances. (Lang-USGS)
W71-13604

GROSS PHYSICAL AND BIOLOGICAL EFFECTS OF OVERBOARD SPOIL DISPOSAL IN UPPER CHESAPEAKE BAY,
Chesapeake Biological Lab. Solomons, Md.
L. E. Cronin.
National Resources Institute Special Report No. 3, 66 p. 65 fig, 35 tab, 84 ref.

Descriptors: *Dredging, *Channel improvement, *Water resources, *Land resources, *Aquatic habitats, *Ecosystems, *Geologic investigations, *Biological communities, Hydrography, Phytoplankton, Benthos, Larvae, Fish population, Fish behavior, Fish migration, Striped bass, Fishkill, Salinity, Sedimentation, Bottom flora, Bottom fauna, Zooplankton, Spawning, Mollusks, Water pollution effects.
Identifiers: *Overboard spoil disposal, Fish eggs, Upper Chespeake Bay, Delaware Canal, Tidal hydraulics, Spoil disposal effects, Nutrients, Chlorophyll concentrations, Species diversity.

Enlargement of the Chesapeake and Delaware Canal and its approaches required that large volumes of bottom material be removed from channel areas and relocated. Officials of the State of Maryland noted that the proposed area of dredging and dumping is of enormous importance to the aquatic resources of the Chesapeake Bay, and expressed concern about the possibility of damage to these resources. As a result, a program of field studies was undertaken in specified areas of the Upper Chesapeake Bay before, during, and after dredging and overboard disposal. The projects undertaken as a part of the program investigate the normal fauna and flora of the area, determine the gross benefits or damage from dredging, provide background for future quantitative studies of the effects, and conduct specialized geological analyses on samples provided by the U.S. Army Corps of Engineers. (Currer-PAI)
W71-13721

OLYMPIA OYSTER CO. V. RAYONIER, INC. (ACTION FOR DAMAGES FROM WATER POLLUTION DISMISSED FOR FAILURE TO SHOW VIOLATION OF PERMIT).
For primary bibliographic entry see Field 06E.
W71-13722

REPORT OF THE FAO TECHNICAL CONFERENCE ON MARINE POLLUTION AND ITS EFFECTS ON LIVING RESOURCES AND FISHING.
Food and Agriculture Organization (UN), New York. Fishery Resources Div.

FAO Fisheries Reports, No. 99, FIRM/R99 (En), Rome, Italy, 9-18 December 1970. 188 p. 132 ref.

Descriptors: *Pollution abatement, *Water pollution effects, *Water pollution sources, *Fisheries, Oil wastes, Fish reproduction, Waste disposal, Marine microorganisms, Sedimentation, Algae, Invertebrates, Radiation, Ecosystems, Estuaries, Coral, Reefs, Water resources, Systems analysis, Waste treatment, Air pollution, Legislation, Benthic flora, Forecasting, Larvae, Lagoons, DDT, Enzymes, Mollusks, Nutrients, Radioisotopes, Viruses, Sewage, Eutrophication, Toxicity, Legal aspects, Phytoplankton.

The FAO Technical Conference included in principle the consideration of all types of pollutants, from whatever source, and in all sea areas with reference to the Conference's definition of 'Marine Pollution.' General objectives were to concentrate in

one place as much as possible of world-wide knowledge of marine pollution, to consider ways of preventing pollution in marine waters, to focus attention on scientific problems where international cooperation was imperative, and to provide scientific and technical guidelines for the international control of marine pollution. (Currer-PAI)
W71-13723

LIFE AND DEATH OF THE SALT MARSH,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 02L.
W71-13724

OIL POLLUTION ON WAKE ISLAND FROM THE TANKER R C STONER,
National Marine Fisheries Service, Honolulu, Hawaii. Area Fishery Research Center.
R. M. Gooding.
United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, 1971 Special Scientific Report - Fisheries No. 63, 12 p, 8 fig, 2 tab.

Descriptors: *Oil wastes, *Water pollution effects, *Fishkill, Invertebrates, *Lethal limit.
Identifiers: *Oil spills, *Reef fishes, Fuel spills, Reef contamination, Kill estimation, Lethal effects.

On September 6, 1967, the tanker R. C. Stoner foundered on the reef just off the harbor entrance to Wake Island. During the following 10 days the vessel's cargo of over six million gallons of high octane aviation gasoline, aviation jet fuel, aviation turbine fuel, diesel oil, and Bunker C. Black oil was spilled along the southern coast of the island. A shore and underwater survey of the coastline showed that an estimated 2,500 kg of inshore reef fishes were killed; numerous other fish and invertebrates were probably killed. Evidence indicates most of the kill occurred on the shallow reef flat. (Currer-PAI)
W71-13725

EFFECTS OF ORGANIC ENRICHMENT ON BENTHIC FAUNA IN A TIDAL RIVER,
Raytheon Environmental Research Lab., New London, Conn.
W. L. Zemaitis and G. V. Cox.
In: Marine Technology Society 7th Annual Conference, August 16-18, 1971, Washington, D.C., p 629-638. 3 fig, 3 tab, 10 ref.

Descriptors: *Biochemical oxygen demand, *Estuaries, *Benthic fauna, *Organic wastes, Mathematical models, Waste disposal, On-site investigations, Water pollution effects.
Identifiers: *Limnodrilus cervix, *Organic enrichment, *Aquatic Oligochaeta, Delaware Estuary, Feeding habits, Polymers, Waste discharge analysis.

The Delaware Estuary receives organic enrichment from overtaxed waste-treatment plants, combined-sewer overflows, and direct discharges from industrial sources. Benthic invertebrates of the Delaware, mainly Limnodrilus cervix, reflect organic enrichment by their distribution and abundance. Aquatic Oligochaeta are responsible for secondary pollution in the estuary due to their sediment recycling habits. The worms release organics trapped in sediment by feeding activities, and dissolve relatively inert polymers which then exert a BOD in the water. This BOD is not estimated in river water samples or in waste discharge analyses, and mathematical modeling of estuary systems would neglect significant real BOD if this benthic community were ignored. (Currer-PAI)
W71-13737

AUTOMATED PRIMARY PRODUCTIVITY INSTRUMENT,
Biospherics, Inc; Rockville, Md.
For primary bibliographic entry see Field 07B.
W71-13741

THE THREAT OF OIL POLLUTION TO NORTH SCOTTISH SEABIRD COLONIES,
Aberdeen Univ. (Scotland). Seabird Group.
W. R. P. Bourne and L. Johnston.
Marine Pollution Bulletin, Vol 2, No 8, August 1971, p 117-119. 2 fig, 1 tab, 5 ref.

Descriptors: *Oil wastes, *Water pollution effects, *Water birds, Nests.
Identifiers: *Breeding colonies, Scotland, Guillemots, Kittiwakes, Fulmars, Puffins, Razorbills, Oil pollution.

A report is made of the oil pollution incident in northern Scotland in which 1,200 dead birds, mainly guillemots, were found. It is recommended that, with the increasing likelihood of oil pollution in this area, the seabird communities will need to be watched and protected all year round. (Currer-PAI)
W71-13742

OWENS V. UNITED STATES (LIABILITY OF UNITED STATES FOR NEGLIGENT APPLICATION OF INSECTICIDE, POLLUTING POND OF ADJACENT LANDOWNER).
For primary bibliographic entry see Field 06E.
W71-13745

THE KENT COAST IN 1970,
British Museum London (England). Dept. of Botany.
I. Tittley.
Marine Pollution Bulletin, Vol 2, No 8, August 1971, p 120-122. 3 fig, 22 ref.

Descriptors: *Water pollution effects, *Data collections, Algae, Ecotypes, Industrial plants, Industrial wastes, Oil wastes, Estuaries, Monitoring.
Identifiers: *Kent coast, Industrial expansion, Isle of Thanet, Medwell Estuary.

A pollution record is compiled for the Kent coast. The effects of coast 'protection' on the cliff flora and the problems of industrial expansion on the Medway are described. (Currer-PAI)
W71-13746

SCIENTIFIC ASPECTS OF THE OIL SPILL PROBLEM,
Woods Hole Oceanographic Institution, Mass. Dept. of Chemistry.
For primary bibliographic entry see Field 05G.
W71-13760

EFFECTS ON FISHERIES AND THEIR EVALUATION,
Ministry of Agriculture, Fisheries, and Food, London (England).
For primary bibliographic entry see Field 05G.
W71-13761

OIL POLLUTION AND SEABIRDS,
Nature Conservancy, Abbots Ripton (England). Monks Wood Experimental Station.
For primary bibliographic entry see Field 05G.
W71-13762

EVIDENCE OF HYPERPLASIA IN AN ESTUARINE BRYOZOAN ATTRIBUTABLE TO COAL TAR DERIVATIVES,
National Museum of Natural Sciences, Ottawa (Ontario).
For primary bibliographic entry see Field 05G.
W71-13763

THE BIOLOGICAL PROBLEMS OF THE STRUGGLE AGAINST HYDROCARBONS BY COUNTERMEASURES, LE PROBLEME BIOLOGIQUE DE LA LUTTE CONTRE LES HYDROCARBURES PAR TENSIOACTIFE,
Institut Royal des Sciences Naturelles de Belgique, Brussels.
For primary bibliographic entry see Field 05G.
W71-13769

SOUTHERN WORKERS REPORT RESEARCH,
W. M. Smith.
Poultry Digest, March 1971, p 136-137.

Descriptors: *Eggs, *Effects, *Poultry, *Farm wastes, DDT, Phosphorus, Proteins, Confinement pens, Oysters, Calcium, Feeds, Amino acids, Wheat, Sodium.
Identifiers: *Egg shells, Egg quality, Egg production, Albumen, Chicken housing, Cow manure.

The text gives summaries of papers presented at a recent meeting of the Association of Southern Agricultural Workers at Jacksonville, Florida. Lighting eggs during incubation may hasten their hatching. Egg production drops after six weeks of feeding DDT at 1200 ppm; shell thickness and shell weight are reduced about 10%. Wire-floor-reared pullets were heavier at 4 and 20 weeks, laid better, and lived better than those raised on litter. Oyster shell strengthens egg shells. Caged hens require more sodium in the ration than do those on litter. (Hazen-Iowa State)
W71-13790

GROWTH INHIBITORS PRODUCED BY THE GREEN ALGAE (VOLVOCACEAE),
Kentucky Univ., Lexington. Dept. of Botany.
D. O. Harris.
Archiv fur Mikrobiologie, Vol 76, p 47-50, 1971. 2 tab, 9 ref. OWRR A-018-KY (1).

Descriptors: *Chlorophyta, *Inhibitors, Algal control, Plant growth regulators, Plankton, Cultures, Water pollution effects.
Identifiers: Heteroinhibitors, Autoinhibitors, Volvocaceae, Pandorina morum, Platydorina caudata, Eudorina californica, Eudorina illinoisensis.

Cells of 12 strains of Volvocaceae green algae were removed by filtration from the nutrient medium after 21 day growth. The cell-free media were inoculated with test genera and incubated for 14 days. The growth inhibitory effect was determined on the basis of optical density of Millipore-filtered and autoclaved cultures. Culture filtrates of Pandorina morum, Volvulina pringsheimii and Eudorina californica were inhibitory to most members of the family. A hope is expressed that these natural inhibitory substances will eventually serve to control the undesirable growth of algae in water basins. (Wilde-Wisconsin)
W71-13793

ADENOSINE TRIPHOSPHATE CONTENT OF SELENASTRUM CAPRICORNUTUM,
Wisconsin Univ., Madison. Dept. of Soil Science; and Wisconsin Univ., Madison. Water Chemistry Lab.
C. C. Lee, R. F. Harris, J. K. Syers, and D. E. Armstrong.
Applied Microbiology, Vol 21, No 5, p 957-958, 1971. 1 tab, 6 ref.

Descriptors: *Trophic levels, *Bioassay, Phosphorus, Nutrients, Measurement, Bacteria, Algae, Eutrophication, Data collections, Test procedures, Cycling nutrients, Analytical techniques, Water pollution effects, Pollutant identification.
Identifiers: *Adenosine triphosphate, *Selenastrum capricornutum.

To quantify the living biomass of heterogeneous microbial populations in seeking accurate evaluation and eventual understanding and control of nutrient cycles and other environmental phenomena mediated by micro-organisms, a study was made of adenosine triphosphate as a parameter of living microbial biomass. The potential of ATP as a parameter depends on the assumption that ATP is present in a relatively constant or predictable amount in diverse microorganisms. Selenastrum capricornutum was chosen as test organism for bioassay; its unicellular characteristics

facilitated accurate measurement of viable and total algal cells for critical evaluation of ATP-living biomass relationships. Based on the use of the 4-day biomass values as valid reflections of living biomass, S capricornutum contained 3.4, 3.1 and 1.4 micrograms of ATP/mg (dry weight) of living biomass under phosphorus-rich, balanced, and phosphorus-deficient conditions, respectively. The effect of growth stage on ATP cell content was apparently much less pronounced for S capricornutum than for bacteria. These data tend to support the potential of ATP measurements for providing valid approximations of fluctuations in living microbial biomass in surface waters where algae are major contributors to the total microbial population. (Jones-Wisconsin)
W71-13794

EFFECT OF SELECTED FACTORS ON PESTICIDE SORPTION AND DESORPTION IN THE AQUATIC SYSTEM,
Missouri Univ., Rolla. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W71-13800

THE UPTAKE AND CONCENTRATION OF FLUORIDE BY THE BLUE CRAB, CALLINECTES SAPIDUS,
Radford Coll., Va. Dept. of Biology.
D. J. Moore.
Chesapeake Science, Vol 12, No 1, p 1-13, March 1971. 11 fig, 3 tab, 28 ref. OWRR B-004-NC (10).

Descriptors: *Fluorides, *Public health, *Crabs, *Water pollution effects, *Mine wastes, *Absorption, *Self-purification, Inorganic compounds, Fluorine, Bioindicators, Water pollution sources, Commercial shellfish, Crustaceans, Invertebrates, Chemical wastes, Bioassay, Lethal limit, Resistance, Shellfish.
Identifiers: Human food, Callinectes sp.

The influence of a phosphate mine was studied which releases substantial quantities of fluorides into the marine environment. Blue crabs (Callinectes sapidus) were challenged in static bioassay with graded concentrations of NaF. Increasing fluoride concentration caused more pronounced decreases in growth, as indicated by carapace width. At experimental NaF concentrations, theexoskeleton, gill, hepatophancreas and muscle all accumulated significant amounts of the pollutant. Depuration of these tissues occurred within 30 days in fluoride-free water. At 20 ppm NaF, crab muscle accumulated 12.5 pp, (wet weight) or 50 ppm (dry weight), which may indicate a potential hazard to man, the potential consumer. (LeGore-Washington)
W71-13802

FIELD CROP IRRIGATION WITH OXIDATION POND EFFLUENT,
Mississippi State Univ., State College. Dept. of Agricultural and Biological Engineering; and Mississippi Agricultural and Forestry Experiment Station.
J. B. Allen, and J. C. McWhorter.
Available from the National Technical Information Service as PB-203 424, $3.00 in paper copy, $0.95 in microfiche. American Society of Agricultural Engineers, Paper No 71-246. 29 p, 10 tab, 8 fig, 12 ref. OWRR A-040-MISS (3).

Descriptors: *Oxidation lagoons, *Biochemical oxygen demands, Furrow irrigation, Rainfall, Wheat, Soybeans, Sudangrass, Clovers, Alfalfa, Mississippi crop yield, Nutrient requirements, Nitrogen, *Irrigation efficiency, *Water reuse.
Identifiers: Test plot, Coliform density.

The purpose of this 18-month study was to investigate the use of oxidation pond effluent for the irrigation of wheat, soybeans, sudax, alfalfa, and sweet clover in Mississippi. The study was conducted at the Agricultural and Biological Engineering Farm using effluent from a 2/3 acre oxidation pond located at the farm. All plots were furrow irrigated. Three irrigation treatments were used; irrigation with effluent, conventional irrigation, and no irrigation. A total of 23.8 inches of irrigation water was applied during the period from May 13, 1969 to October 29, 1970. The observed rainfall during this period was 81.95 inches, and the total of rainfall plus irrigation was 105.8 inches. At various times during the first growing season, samples of the effluent from the oxidation pond, the ground water beneath the plots, and stream flow from nearly sampling locations were collected for bacteriological and chemical analysis. The yield responses to both types of irrigation were small, probably because of a high ground water table at the plot location. There were no large yield responses resulting from the nutrients contained in the oxidation pond effluent. These nutrients were not sufficient to maintain a high level of crop production. (Bundy-Iowa State)
W71-13807

WATERSHED ANALYSIS RELATING TO EUTROPHICATION OF LAKE MICHIGAN,
Michigan State Univ., E. Lansing. Inst. of Water Research.
M. E. Stephenson, and J. R. Waybrant.
Available from the National Technical Information Service as PB-203 425, $3.00 in paper copy, $0.95 in microfiche. Technical Report No 11, February 1971. 118 p, 11 fig, 6 tab, 48 ref, 13 append. OWRR A-023-MICH (1).

Descriptors: *Watersheds (Basins), *Lake basins, *River basins, *Eutrophication, *Lake Michigan, Lakes, Agricultural watersheds, Water quality, *Phosphorous, Nitrogen, Michigan, Water temperature, Nutrients, Water pollution effects.
Identifiers: *Nitrate-nitrogen levels, *Grand River basin (Mich), *Watershed runoff.

The influence of municipal and agricultural practices on stream water quality in the Grand River Basin was examined in terms of the resulting phosphorus and nitrogen inputs to Lake Michigan. Phosphorus and nitrogen concentrations in the Grand River watershed indicated that nitrate-nitrogen fluctuated significantly with changes in temperature and photoperiod, while total phosphorus concentrations were not influenced by these indexes of biological activity. A study of nutrient concentrations in runoff from watersheds of predominantly urban, natural, or agricultural land usages indicated significant differences: (1) the natural watershed runoff contained less nitrate-nitrogen than did runoff from either the urbanized or agricultural watersheds; (2) urbanized land runoff contained far greater concentrations of phosphorus than did runoff from either natural or agricultural watersheds and (3) natural and agricultural land runoff did not contain significantly different concentrations of total phosphorus. General observations of nutrient fluctuations in the Grande River system indicated evidence of possible nitrogen-limitation during the period of surveillance.
W71-13808

EFFECT OF LOW pH ON THE SURVIVAL AND EMERGENCE OF AQUATIC INSECTS,
Environmental Protection Agency, Duluth, Minn. National Water Quality Lab.
For primary bibliographic entry see Field 05B.
W71-13815

APPRAISAL OF CHEMICAL AND BIOLOGICAL CONDITIONS OF LAKE OKEECHOBEE, FLORIDA, 1969-70,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 02H.
W71-13849

WATER QUALITY CRITERIA FOR EUROPEAN FRESHWATER FISH - EXTREME pH VALUES AND INLAND FISHERIES,
Food and Agriculture Organization of the United Nations, Rome (Italy). European Inland Fisheries Advisory Commission.
R. Lloyd, P. Doudoroff, W. A. Spoor, and A. Coche.
Water Research, Vol 3, p 593-611, August 1969. 1 tab, 75 ref.

Descriptors: Water quality, *Freshwater fish, Fish, *Standards, *Acidity, *Alkalinity, Environment, Water pollution effects, *Hydrogen ion concentration, *Reviews.
Identifiers: *Water quality criteria, *Inland fisheries, European freshwater fish.

The conclusions are the result of a critical review which has been made of published and unpublished data on both the direct and indirect effects of extreme pH values on fish, with an emphasis on the European species. This review demonstrates that the existing data are not sufficiently comprehensive to establish definite pH criteria for each fish species and for different environmental conditions. The problems which need further investigation are indicated in the article. Sufficient evidence was found to support the following general conclusions. (1) There is gradual deterioration of the fisheries as pH values are further removed from the normal range. There is not a definite pH value within which a fishery is unharmed and outside which it is damaged; (2) Below a pH value of 5.0 fish mortalities may be expected, and the corresponding yield from a fishery will be less; (3) Little is known about the effects of alkaline discharges on a fishery, perhaps indicating the lesser importance of this problem. (Strachan-Chicago)
W71-13893

OIL POLLUTION INCIDENT, PLATFORM CHARLIE, MAIN PASS BLOCK 41 FIELD, LOUISIANA.
Alpine Geophysical Associates, Inc., Norwood, N.J.

Copy available from GPO Sup Doc as SN-5501-0130, $1.25; microfiche from NTIS as PB-203 497, $0.95. EPA, Water Quality Office Report, May 1971. 134 p, 27 fig, 5 tab, 15 ref. EPA Program 15080 FTU 05/71, Contract No. 14-12-860.

Descriptors: *Oil, *Oil wastes, Oil fields, Ecosystems, Environmental effects, Control, Industrial wastes, Oil wells, Surveys, Biological communities.
Identifiers: *Oil spill.

A documentation team observed the Chevron spill incident and interviewed key personnel concerned . Little damage to the environment was observed, mostly due to a combination of fortuitous circumstances. Considerable knowledge was gained concerning the physical limitations of spill control in open water. (Hirshman-Alpine Geophysical)
W71-13894

ENVIRONMENTAL IMPACT OF HIGHWAY DEICING,
Edison Water Quality Lab., N.J.
For primary bibliographic entry see Field 04C.
W71-13898

THE HEALTH EFFECTS OF NITRATES IN WATER (PANEL DISCUSSION),
Missouri Univ., Columbia. School of Veterinary Medicine.
A. A. Case.
Available from Engineering Publications Office, 112 Engineering Hall, University of Illinois, Urbana 61801 - Price $4.50. In: Proceedings 12th Sanitary Engineering Conference on Nitrate and Water Supply: Source and Control, February 11-12, 1970, University of Illinois Urbana: Illinois University, College of Engineering Publication, p 40-50, 1970. 11 p, 7 tab, 46 ref, append.

Descriptors: *Nitrites, *Nitrates, *Water pollution effects, *Toxicity, *Water quality, Path of pollutants, Human pathology, Pathology, Public health, Safety.
Identifiers: Health effects (Nitrates).

Toxicity of nitrate and nitrite are compared, and the effect of the source, such as water or feed, on the availability of the ions is discussed. The toxicity of these ions in animals is increased under various types of physiological stress. The wide variation in the activity spectrum of the nitrate-nitrite system makes it unwise to establish arbitrary limits in water supplies for either man or animals, especially when the margin between 'safe' doses and toxic levels may be dangerously narrow. Sources of nitrate and nitrite in farm water supplies and the interference of these ions in the metabolism of various animals are reviewed. (Knapp-USGS)
W71-13935

THE HEALTH EFFECTS OF NITRATES IN WATER (PANEL DISCUSSION),
Illinois Univ., Chicago. Dept. of Preventive Medicine.
Abraham Gelperin.
Available from Engineering Publications Office, 112 Engineering Hall, University of Illinois, Urbana 61801 - Price $4.50. In: Proceedings 12th Sanitary Engineering Conference on Nitrate and Water Supply: Source and Control, February 11-12, 1970, University of Illinois, Urbana: Illinois University, College of Engineering Publication, p 51-52, 1970. 2 p.

Descriptors: *Public health, *Illinois, *Nitrates, *Toxicity, *Water quality, Water pollution effects, Surveys, Sampling, Human pathology, Pathology, Safety.
Identifiers: Health effects (Nitrates).

Several different investigations into the deleterious effects of 'excess' nitrates, especially effects such as methemoglobinemia in infants, are reviewed. One investigation used two sets of Illinois counties to compare the physiological effects of high nitrate or low nitrate water supplies. Another investigation concerned methemoglobin tests on newborn babies and their mothers. Data from hospital tests as well as specimens of well water and a set of data correlating cancer-related statistics with nitrate levels are submitted to the Department of Preventive Medicine at the University of Chicago. These studies have not only health implications but also economic ramifications. (Knapp-USGS)
W71-13936

THE HEALTH EFFECTS OF NITRATES IN WATER (PANEL DISCUSSION),
California State Dept. of Public Health, Berkeley. Bureau of Sanitary Engineering.
P. C. Ward.
Available from Engineering Publications Office, 112 Engineering Hall, University of Illinois, Urbana 61801 - Price $4.50. In: Proceedings 12th Sanitary Engineering Conference on Nitrate and Water Supply: Source and Control, February 11-12, 1970, University of Illinois Urbana: Illinois University, College of Engineering Publication, p 53-54, 1970. 2 p.

Descriptors: *Public health, *Illinois, *Nitrates, *Toxicity, *Water quality, Water pollution effects, Surveys, Sampling, Human pathology, Pathology, Safety.
Identifiers: Health effects (Nitrates).

A discussion is presented on the problems of educating the public to the dangers of nitrates exceeding the recommended limit in the public water supplies. There is also a discussion of the objectives of current investigations into the effects of nitrate and nitrite on infants. These studies are being carried on in the hope that they will result in a rational, firm standard which can be used to exert a better, more rational stewardship of groundwaters. (Knapp-USGS)
W71-13937

EFFECTS OF PLACER MINING ON WATER QUALITY IN ALASKA.
Federal Water Pollution Control Administration, College, Alaska, Alaska Water Lab.
For primary bibliographic entry see Field 05B.
W71-13955

AIR POLLUTION ASPECTS OF ODOROUS COMPOUNDS,
Litton Systems, Inc., Bethesda, Md. Environmental Systems Div.
Ralph J. Sullivan.
Available from the National Technical Information Service as PB-188089, $3.00 in paper copy, $0.95 in microfiche. September 1969. 245 p, 3 fig, 444 ref. Contract No PH-22-68-25.

Descriptors: *Odor, *Air pollution effects, *Classification, Air pollution, Air environment, Pollution abatement, Costs, Property values, Farm wastes, Effects, Public rights, Theoretical analysis, Economics.
Identifiers: *Odor perception, *Sources, Detector, Nose, Description, Characteristics, Intensity, Acceptability, Public opinion, Allergies.

Offensive odors provoke people into complaining about air pollution. They may cause both mental and physiological effects such as nausea, headache, loss of sleep, loss of appetite, impaired breathing, and in some cases, allergic reactions. The most offensive odors come from Kraft paper mills, animal rendering plants, chemical plants, petroleum refineries, diesel engines, sewers and sewage treatment plants, and metallurgical plants. The most generally accepted method for abating most odor pollution problems is incineration. Other methods of control include: adsorption, chemical scrubbing, containment, process changes, and masking or counteracting the odors. The cost of abatement depends on the odor pollution problem and the source. The human nose is the only reliable odor detector. (Christenbury-Iowa State)
W71-13984

EFFECTS OF ATMOSPHERIC AMMONIA ON THE PIG,
Ohio Agriculture Research and Development Center, Wooster. Dept. of Agricultural Engineering; and Ohio Agriculture Research and Development Center, Wooster. Dept. of Animal Science.
D. P. Stombaugh, H. S. Teague, and W. L. Roller.
Journal of Animal Science, Vol 28, 1969, p 844-847. 2 fig, 2 tab, 7 ref.

Descriptors: *Hogs, *Ammonia, Air pollution, *Air pollution effects, Toxicity, Ventilation, Farm wastes, Confinement pens, Odor, Gases, Growth rates, Laboratory tests.
Identifiers: *Response, Anhydrous ammonia, Feed consumption, Feed efficiency, Concentration, Exposure time.

Duroc pigs were subjected to four levels of ammonia air contamination. Ammonia concentration had a highly significant adverse effect upon feed consumption and average daily gain. There was no significant effect upon efficiency of feed conversion. Corynebacterium and Pasteurella were isolated from the ethmoid turbinates of two animals, otherwise all gross, microscopic and bacteriological observations were unaffected by ammonia concentrations. Frequency of coughing was increased in animals exposed to the higher ammonia levels. (Hazen-Iowa State)
W71-13985

5D. Waste Treatment Processes

FUNGI IN THE LEBANAN SEWAGE TREATMENT PLANTS AND IN TURTLE CREEK, WARREN CO., OHIO,
W. B. Cooke.
Mycopathol Mycol Appl. 41 (1/2): 89-111. 1970, (Ger. summ.).
Identifiers: Adaptation, Carbon, County, Creek, Fungi, Habitat, Isolation, Lebanon, List, Nitrogen, Ohio, Plants, Pollution, Sewage, Techniques, Turtle, USA, Warren.

A variety of isolation techniques in agar and liquid media culture were used to isolate 101 spp. of filamentous fungi and yeasts from samples of materials from Turtle Creek and 100 spp. of fungi from secondary and tertiary treatment processes in the Lebanon sewage treatment plant. The combined list totals 142 spp. Based on such habitat factors as total organic C, and organic N, the distribution of these fungi was discussed in relation to 7 sampling points in the secondary-type treatment system, 8 in the tertiary treatment systems, and 5 sampling points along Turtle Creek, 2 above the outfall from the Lebanon sewage treatment plant, 1 at the outfall, and 2 below that outfall. As in Lytle Creek, (Ohio), Bear River in the Cache Valley (Utah and Idaho), and the Cache la Poudre River (Colorado), a group of fungi made up of many of the same species is adaptable to conditions of organic enrichment of streams from sewage or industrial wastes additives. These contribute to the removal of polluting organic matter. At least monthly sampling from any group of stations is needed to describe the populations more accurately and more meaningfully.—Copyright 1971, Biological Abstracts, Inc.
W71-13126

VIRUS REMOVAL BY CHEMICAL COAGULATION,
Tennessee Univ., Knoxville.
David W. York.
Master's Thesis, August 1970. 114 p, 12 fig, 29 tab, 33 ref. OWRR Project A-018-TENN (1).

Descriptors: *Viruses, *Water purification, *Coagulation, Flocculation, Separation techniques, Precipitation (Chemical), Turbidity, Color, Chemical oxygen demand, Filtration, Chlorination, Disinfection, Isolation, Centrifugation, Public Health, Waste water treatment.
Identifiers: *Polyelectrolytes, *Coagulant aids.

Inactivation of viruses has not been accomplished to a sufficient degree through the use of conventional water treatment techniques, including chlorination. Since virus removals are essential in safeguarding the public health, several studies have been conducted concerning the virus removal and/or inactivation capabilities of several coagulants. In all previous work, no common denominator was evolved by which different coagulants could be compared, therefore this investigation was rigidly structured and all tests were performed according to Standards Methods. The f2 bacteriophage was the virus used throughout the study. Coagulants used were aluminum sulfate and ferric chloride. These two coagulants provided removals in excess of 99% when used alone, and also provided the best turbidity, COD, and color removals. Anionic, cationic, and non ionic polyelectrolytes, used as coagulant aids did not significantly increase the efficiency of virus removal or reduction of other contaminants over removals obtained by aluminum sulfate alone. Addition of small dosages of sodium aluminate did increase both viral removals and contaminant reduction. Optimum concentrations of aluminum sulfate and ferric chloride were 20-25 mg/l and 50 mg/l respectively. (Lowry-Texas)
W71-13146

SEWAGE AND INDUSTRIAL WASTE TREATMENT REQUIREMENTS AND EFFLUENT CRITERIA.
Illinois Dept. of Public Health, Springfield. Sanitary Water Board.
For primary bibliographic entry see Field 06E.
W71-13198

ENGINEERING RESPONSIBILITIES IN PROTECTING THE MARINE ENVIRONMENT,
Water Pollution Control Federation, Washington, D.C.
For primary bibliographic entry see Field 05C.
W71-13253

MANAGEMENT OF INDUSTRIAL OIL SPILLS,
Alken-Murray Corp., New York.
For primary bibliographic entry see Field 05G.
W71-13290

DEMINERALIZATION OF RECLAIMED WATER,
Los Angeles County Sanitation District, Calif.
F. D. Dryden.
Industrial Water Engineering, Vol 8, No 7, p 24-26, August - September 1971. 2 fig. (Partially financed by FWQA).

Descriptors: *Water reuse, *Reclamation, *Waste water treatment, *Water pollution control, *Demineralization, Methodology, Reverse osmosis, Electrodialysis, Ion exchange, Costs, California.
Identifiers: *Pomona (Calif).

The Pomona, California, pilot study for reclaiming waste waters provided a comparative examination of three demineralization processes; reverse osmosis, electrodialysis, and ion exchange. Results indicate that wastewater demineralization is an economical alternative to seawater demineralization. Strong acid-weak base ion exchange so far appears more economical and reliable than the reverse osmosis and electrodialysis systems, for the TDS range of interest. Practical reductions in dissolved solids can be obtained at costs of 20-30 cents/1000 gal where brines can be discharged into the ocean. Since each of the three processes are subject to fouling in the presence of high concentrations of organic matter, activated carbon adsorption is considered an integral part of these demineralization schemes. The coast of activated carbon treatment is estimated at 9 cents/1000 gal for a 10 mgd facility, which must be added to the separate demineralization cost. (Woodard-USGS)
W71-13291

COMPARATIVE EVALUATION OF BIOLOGICAL TYPE FOOD PROCESSING LIQUID WASTE DISPOSAL SYSTEMS,
Maryland Univ., College Park. Dept. of Horticulture.
J. M. Wilson, B. A. Twigg, and A. Kramer.
Completion Report Water Resources Research Center, Maryland University, June 1971. 101 p, 3 fig, 41 tab, 116 ref.

Descriptors: *Waste water treatment, Canneries, *Oxidation, Lagoons, Aerobic treatment, Anaerobic digestion, *Waste disposal, Liquid wastes, *Biological treatment, Aeration.
Identifiers: *Facultative lagoons, *Food processing wastes.

Food processing plants have the capability of discharging up to 36 billion gallons of waste water annually. This liquid waste must be disposed of in a manner which decreases its strength to a level required by water regulatory agencies. Several variations of lagoon type biological systems using two lagoons in series have been investigated over a two year period. The results indicate that the semi-anaerobic-aerated and the forced aerated systems merit further consideration as efficient disposal methods. The open or facultative system serves only as a dumping place with settling as the primary treatment process. The BOD/COD relationships were studied and variations from the ratios reported in the literature were observed. In the forced aeration units the ratio was considerably less than 1.0. The possibility exists that these values could be of assistance in determining the conditions of the lagoon. (Goessling-Texas)
W71-13308

INVESTIGATION OF A NEW PHOSPHATE REMOVAL PROCESS,
Envirogenics Co., El Monte, Calif.
L. M. Soffer, J. R. Lowell, Jr., and B. I. Loran.
Copy available from GPO Sup Doc as EP 2.10:17010DJA 11/70, $.75; microfiche from NTIS as PB-203 069, $0.95. Water Pollution Control Research Series, November 1970. 75 p, 2 fig, 31 tab, 29 ref. EPA Program 17010 DJA 11/70. EPA-WOO 14-12-487.

Descriptors: *Tertiary treatment, *Ion exchange, *Phosphorus, Phosphates, Separation techniques, Resins, Adsorption, Lime, Chemical precipitation, Sedimentation, Cost analysis, *Waste water treatment.
Identifiers: Exhaustion, Regeneration.

Two new types of resins were subjected to laboratory evaluations of their technical and economic feasibility for use in phosphate removal. Multivalent metal derivatives of sulfonic acid resins were found to have good phosphorus capacities. The Iron (III) form of Amberlite 200 strong acid cation exchange resin, for example, exhibited capacities of up to 9.5 mg P/ml of wet resin, and in tests with secondary effluent, a 2.7 mg P/ml capacity was obtained. Exhausted resin was easily regenerable with dilute ferric chloride solution, and after ten exhaustion-regeneration cycles were performed on one sample, no detectable loss of phosphorus capacity was observed. The iron and phosphorus removed from the waste water and concentrated in the waste brine were subsequently removed from the waste brine by lime addition and settling. A thorough cost analysis including both fixed construction costs as well as operation and maintenance costs, established the price of waste water treatment by this method as 34.38 cents/1000 gal. The second resin type removed only 25 to 35% as much phosphorus as commercially available resins and was therefore dismissed. (Lowry-Texas)
W71-13309

DNA CONCENTRATION AS AN ESTIMATE OF SLUDGE BIOMASS,
Southwest Missouri State Coll. Springfield.
Roar L. Irgens.
Copy available from GPO Sup Doc as SN5501.0112, $.40; microfiche from NTIS as PB-203 070, $0.95. Water Pollution Control Research Series, February 1971. 21 p, 4 fig, 6 tab, 2 ref. EPA Program 17070 DHO 02/71.

Descriptors: *Cells, *Sludge, *Bioindicators, Laboratory tests, Separation techniques, Filtration, Ultraviolet radiation, Centrifugation, Activated sludge, Microorganisms, Biodegradation, Waste water treatment.
Identifiers: *Deoxyribonucleic Acid, *Most probable number, Lysis, Sonication, *DNA.

Experiments were conducted on various activated sludge samples over a span of several months to determine the feasibility of using cell DNA as an estimate of sludge biomass. These investigations demonstrated that free DNA released into a solution of viable microorganisms by lysis of cells was rapidly degraded. Therefore, DNA obtained from such cultures would effectively be DNA from viable organisms. Crude DNA was extracted from activated sludge by rupturing the cells by Sonication and centrifuging the sonicated sludge, heating at 70C to pasteurize the supernatant, and centrifuging again. Estimation of cell population was made by assuming the weight of one cell to be 1 x 10 to the minus 9 power mg, and the DNA content of organic matter to be about 4% of the total weight of the organic matter. Population sizes based on DNA analyses were checked by using the MPN method. Values obtained were similar to values obtained with other methods. (Lowry-Texas)
W71-13310

MATHEMATICAL MODELS OF THE STEP-AERATION PROCESS,
Mississippi State Univ., State College. Dept. of Civil Engineering.
P. A. Lipscomb.
Master's Thesis, January 1968. 71 p, 15 fig, 11 ref.

Descriptors: *Mathematical models, *Systems analysis, *Aeration, Operations research, Microorganisms, Water reuse, Subsurface drainage, Aeration, Pistons, Washouts, Effluent, Mixing, Nutrients, Growth rates, Flow rates, Waste water treatment.
Identifiers: *Step-aeration, *Piston-flow system.

A computer program was set up in which material balances over the reactor basin were used to form two mathematical models. One describes the relationship between the substrate concentration in the reactor and detention-time for step-aeration systems in which it is assumed that only piston-flow exists. This equation also made use of three fundamental relationships concerning the continued cultivation of microorganisms: (a) growth rate, (b) relationship between an essential nutrient and growth rate, and (c) growth yield. The second equation describes the relationship between effluent organism and substrate concentration. It was found from the solution of the equation that: (1) both step-aeration system models produce a greater organism increase than do models of piston flow and completely mixed systems; (2) introducing recycle into increment 1 in the step-aeration model produces a greater substrate removal rate and a lower 'washout time' than does the piston-flow model; (3) introducing recycle into the influent in the step-aeration model produces a lower substrate removal rate and a higher 'washout time' than does the piston-flow system model; (4) the step aeration and piston-flow models produce greater substrate removal and organism increase rates than do the completely mixed systems, making it possible to have greater flows per reactor volumn, or smaller reactor volumns per flow for the step-aeration and piston-flow systems than had the completely mixed systems and (5) the step-aeration models show a greater variation in influent organism and substrate concentrations with a change in recycle factor, than a change in concentration factor. (Adkins-Texas)
W71-13311

INFLUENCE OF SHAPE ON THE PERFORMANCE OF MUNICIPAL SEWAGE LAGOONS,
Mississippi State Univ., State College, Dept. of Civil Engineering.
W. C. Murphy.
Master's Thesis, August 1968. 101 p, 26 fig, 6 tab, 19 ref.

Descriptors: *Sewage lagoons, *Shape, Quality control, Sludge, Effluent, Sedimentation, Anaerobic digestion, Biochemical oxygen demand, Dissolved oxygen, Chemical oxygen demand, Load distribution, Analytical techniques, Statistical methods, Sewage treatment, Mississippi, *Waste water treatment.
Identifiers: *Noxapeter, *Kosciusko.

In order to observe the significance of the shape of municipal sewage lagoons, a study was made of two lagoons in Mississippi. Emphasis was placed on distribution of dissolved oxygen, biochemical oxygen demand, Chemical oxygen demand, total suspended solids, volatile suspended solids, and effluent quality. The study focused on two towns in Mississippi, each of which contained two lagoons of different shapes. One had a circular and a 2:1 rectangular lagoon while the other had an irregularly shaped and a 1.5:1 rectangular lagoon. Samples taken in early March and late May came generally from every break in the perimeter of the lagoons as well as the central portions, depending upon the shape of the lagoon being studied. Analytical techniques used included the computation of mean values and standard deviations for each analytical parameter to evaluate the distribution. Analyses of the concurrent effluent samples were made to compare quality. Analysis of the results showed that shape influences load distribution; but if uniform distribution is not hindered shape appears to have no significant effect on performance. Distribution was found to be less

uniform in the irregular shaped facility. The rectangular lagoons consistently showed higher quality effluents than their circular and irregular shaped counterparts. (Adkins-Texas)
W71-13312

REMOVAL OF PHOSPHOROUS FROM A SEWAGE LAGOON BY HARVESTING ALGA,
Mississippi State Univ., State College, Dept. of Civil Engineering.
J. E. Little.
Master's Thesis, August 1969. 41 p, 11 fig, 2 tab, 30 ref.

Descriptors: *Eutrophication, *Phosphorous, Algae, *Harvesting of algae, Effluent, Quality control, Oxidation lagoon, Nitrogen, Nutrients, Filtration, Microorganisms, Analytical techniques, *Waste water treatment, Treatment facilities, Mississippi.

Eutrophication, defined as the process in which surface bodies of water are enriched by the excessive addition of nutrients, affects as much as 56% of total municipal surface water supplies in the United States. Excessive algal growth in eutrophied water caused difficulties in treating sewage and reduced the recreation value of lakes and streams. Because eutrophication is a product of nutrient enrichment, it was decided that control measures should be based on either removal, reduction, or prevention of the addition of nutrients. Making use of the SEWAGE Lagoon Research Facility at Mississippi State University, an attempt was made to see whether the phosphorous content of an oxidation pond effluent could be brought to acceptable levels through harvesting the algae contained in the pond effluent. A six month study revealed that: (1) harvesting algae reduced the phosphate concentration to 91% maximum removal, (2) harvesting algae will not remove enough phosphorous from oxidation pond effluent to control algal growths in receiving streams and lakes unless a large quantity of almost phosphorous-free water is available for dilution. (3) a filter with a pore size of 45 micron or less appears to remove all insoluble phosphate from oxidation pond effluent, but adequate flow is difficult to attain, (4) it does not appear that the method studied is practical because a significant degree of phosphorous removal is achieved only when BOD removal efficiency is low, thereby defeating the original purpose of oxidation ponds. (Adkins-Texas)
W71-13313

THE REMOVAL OF CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBONS BY ACTIVATED SLUDGE,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
William J. McCaw III.
Master's Thesis, November 1970. 44 p, 5 fig, 6 tab, 19 ref.

Descriptors: *Activated sludge, Organic compounds, *Sludge treatment, *Aromatic compounds, Gas chromatography, Analytical techniques, Adsorption, Enzymes, Metabolism, Sludge, Solubility, Mixing, Temperature, *Waste water treatment.
Identifiers: *Benzo-a-pyrene, *Carcinogens, *Hydrocarbons, Suspended solids.

Both batch and continuous flow activated sludge systems were subjected to small amounts of benzo-a-pyrene to determine whether or not carcinogenic polycyclic aromatic hydrocarbons can be eliminated using conventional biological treatment. The continuous flow study involved the sustained introduction of 0.5 mg/l of benzo-a-pyrene into the aeration chamber. The effluent, analyzed using a Varian Aerograph 1700 Gas Chromatograph, contained virtually none of the hydrocarbon, while the waste sludge contained approximately 17% of the initial amount. The batch test, conducted with the cells of the aeration tank undergoing endogenous respiration, showed no effluent benzo-a-pyrene at influent concentrations of .08, .17, .32, and .64 mg/l benzo-a-pyrene. At concentrations of 1.28 and 2.56 mg/l, 9% and 11% of the total amount injected was found in the respective effluents, pointing to a lack of active adsorption sites. The mechanism of removal was shown to be both physical adsorption and subsequent compound modification. These investigations indicated that conventional biological treatment was an effective barrier to trace amounts of carcinogenic hydrocarbons. Further metabolic studies are needed to establish exact degradation mechanism for these compounds. (Lowry-Texas)
W71-13314

THE EFFECT OF WASTE CONCENTRATION ON VARIABILITY OF THE OXYGEN SAG CURVE IN A POLLUTED STREAM,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
For primary bibliographic entry see Field 05G.
W71-13315

DIGITAL COMPUTER SIMULATION OF WASTE WATER TREATMENT,
Massachusetts Univ., Amherst.
Paul W. Cummings, Jr.
Master's Thesis, University of Massachusetts, August 1969. 171 p, 7 fig, 21 tab, 23 ref.

Descriptors: *Digital computers, *Computer simulation, *Activated sludge, Cost comparisons, Evaluation, Anaerobic digestion, Aerobic conditions, Sedimentation, Sludge, Dewatering, Biochemical oxygen demand, Temperature, Organic loading, Odor, Hydrogen ion concentration, Alkalinity, Aeration, Oxidation, *Waste water treatment.
Identifiers: *Subroutines, Modifications, Volatile solids, Detention time.

The basic activated sludge waste water treatment was simulated under the direction of Robert Smith at the Cincinnati Water Research Laboratory. This computer simulation was then used as the basis for further modification and refinement. Following conception, construction, and testing of the modifications, new subroutines incorporating the modifications were integrated into the original program. Developments modeled in this manned included: (1) the exclusion of primary settling; (2) aerobic sludge digestion; and (3) a more through analysis of sand bed sludge dewatering techniques. Cost analyses indicated that omission of primary sedimentation would result in overall savings of from 7.53% to 11.01% as compared to conventional activated sludge with primary treatment. Sand bed sludge drying was compared with vacuum filtration and incineration and at 2.4 cents/1000 gallons, was found to be considerably more economical. Anaerobic and aerobic sludge digestion were of nearly the same cost, but if sand bed sludge drying was to be used, a substantial final savings would be realized from aerobic digestion due to the better dewatering characteristics of aerobically digested sludges. (Lowry-Texas)
W71-13316

STUDIES OF PHOSPHORUS COAGULATION AND PRECIPITATION USING IRON SALTS FOR APPLICATION IN WASTE WATER TREATMENT,
Massachusetts Univ., Amherst.
Erich O. Tietze.
Master's Thesis, University of Massachusetts, February 1970. 162 p, 28 fig, 11 tab, 47 ref. FWPCA Administration Grant WP-01408-01.

Descriptors: *Phosphorous, *Coagulation, *Chemical precipitation, Iron compounds, Separation techniques, Hydrogen ion concentration, Aeration, Calcium, Solubility, Oxygenation, Filtration, *Waste water treatment, *Eutrophication.
Identifiers: *Ferric chloride, *Ferrous chloride.

Advanced Eutrophication on many lakes and reservoirs has prompted the search for methods of removing phosphates from solution. Most of the work done using coagulation and precipitation has dealt mainly with calcium and aluminum salts. Therefore, in order to determine the feasibility of removing phosphorous by precipitation with either ferric or ferrous chloride, a controlled system was developed, devoid of possibly intefering organic substances Potassium mono-hydrogen phosphate was dissolved in distilled water and known concentrations of ferrous or ferric chloride were added. pH varied from 3.0 to 8.0 in steps of 1.0 unit. Initial phosphorous concentration was 8.15 mg/l as P while initial iron dosage for both ferrous and ferric forms was 30.9 mg/l as Fe. Reaction times consisted of 10 minutes rapid mix, 15 minutes of flocculation, and 2 hours of settling. Both settled and filtered samples were analyzed for ferrous iron, ferric iron, and orthophosphate. At pH 7 to pH 8, both ferrous and ferric chloride obtained between 88 and 92% removal of the initial phosphorous present. Supplemental addition of 12 mg/l calcium was necessary for efficient removal. Although the merits of the process have been indicated, laboratory or pilot plant studies must be performed to determine actual process feasibility. (Lowry-Texas)
W71-13317

REMOVAL OF NON-BIODEGRADABLE ORGANICS FROM AN INDUSTRIAL WASTE,
Kansas Univ., Lawrence. Dept. of Civil Engineering.
James B. Strong.
Master's Thesis, University of Kansas, July 1967. 211 p, 37 fig, 27 tab, 33 ref.

Descriptors: *Organic compounds, *Biodegradation, *Industrial wastes, Analytical techniques, Gas chromatography, Adsorption, Activated carbon, Virginia, Chemical oxygen demand, Hydrogen ion concentration, Temperature, *Waste water treatment.
Identifiers: *Non-biodegradation, *Refractory, Waynesboro (Va).

The industrial waste from the Waynesboro, Virginia synthetic fiber manufacturing plant of E. I. DuPont de Nemours and Company was analyzed to determine the non-biodegradable fraction. Subsequent studies were then undertaken to establish a satisfactory removal method, and to utilize gas chromatography to characterize the non-biodegradable fraction. The amount of non-biodegradable material in the waste stream was determined to be approximately 300 mg/l. The presence of large molecular structures suggested carbon adsorption as a particularly effective removal method. Pilot scale studies established carbon adsorption as a feasible solution and design criteria were established. Gas chromatography techniques were used in an effort to determine the nature of the compounds present in the waste. A consistent chromatogram was established for these but identification of individual peaks was not possible. Although each portion of the plant seemed to contribute almost equally to the non-biodegradable fraction, further characterization studies were indicated. (Lowry-Texas)
W71-13318

THE PRECIPITATION AND FLOTATION OF ORTHOPHOSPHATE USING FERROUS SULFATE, FERRIC SULFATE, AND CALCIUM HYDROXIDE,
Ohio State Univ., Columbus.
Scott M. Barrick.
Master's Thesis, 1969. 108 p, 23 fig, 48 ref.

Descriptors: *Flotation, *Phosphates, Adsorption, *Chemical precipitation, Sedimentation, Neutralization, Coagulation, Iron, Nitrogen, Hydrogen ion concentration, X-ray diffraction, *Waste water treatment.
Identifiers: Sodium lauryl sulfate, Cetyltrimethyl ammonium bromide, *Orthosphates.

Five different operational procedures were used to determine the efficacy of various combinations of sodium lauryl sulfate (NaLS), CTAB (Cetyltrimethyl ammonium bromide), nitrogen, and air flotation systems in removing phosphates from waste effluent. pH was found to be a critical parameter in all combinations. 99% phosphate removal was achieved by flotation with 20 ppm CTAB for pH between 5.2 and 7.0. Phosphate removals in excess of 99% were obtained using 15.8 ppm NaLS for pH between 3.0 and 6.0. Both flotation chemicals conformed well to theoretical charge models for collector adsorption. Close correlation between flotation curves for both NaLS and CTAB indicated removal of a ferrous phosphate compound at pH 7.0 (pH 8.5 for sedimentation). Overall removals using iron sulfate and sodium hydroxide, using a 1.5:1 ferric sulfate to phosphate molar concentration in the pH range from 2.5 to 7.5, were superior. However, NaLS provided the vest removals below pH. 5.0, and CTAB was superior above pH 6.0. The laboratory scale tests displayed the merits of the flotation process, but more data must be obtained from larger scale installations. (Lowry-Texas)
W71-13319

REMOVAL OF ORGANIC SOLUTES FROM WATER BY THE LOW PRESSURE ULTRAFILTRATION PROCESS,
Massachusetts Univ., Amherst.
Donald G. Newton, JR.
Master's Thesis, University of Massachusetts, February 1970. 189 p, 24 fig, 21 tab, 156 ref.

Descriptors: *Membrane processes, *Filtration, *Organic wastes, *Solutes, Separation techniques, Pores, Monomolecular films, Membranes, Pressure, Hydrogen ion concentration, Permeability, Diffusion, Osmosis, Desalination, Surfactants, Hydrolysis, Design criteria, *Waste water treatment.
Identifiers: *Ultrafiltration, Flux, Molecular weight, Rejection.

Ultrafiltration techniques were investigated in an effort to determine the major factors governing the transmission or rejection of certain solutes by the ultrafiltration membranes. Initially, solutions of one solute in one solvent were used to determine the effect of molecular size on the rejection properties. Data obtained supported the 'pore theory' to the extent that larger molecules were subject to a higher percentage of rejection than smaller molecules. In addition, pure water throughput was also decreased indicative of the molecules caught in the pores acting as plugs and preventing the passage of other molecules. The second phase of the study was designed to determine the effect of having more than one solute in solution. The solution consisted of an organic solute, a surface active agent feed additive, and water solvent. The formation of a liquid surfactant film did not inhibit the passage of the sugar due to its low energy of activation. A history of the development of ultrafiltration was presented along with a design schematic and outline for an efficient, low pressure ultrafiltration apparatus. (Lowry-Texas)
W71-13320

THE RELATION OF ORP TO ORTHOPHOSPHATE RELEASE BY ACTIVATED SLUDGE,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
Duane W. Marshall.
Master's Thesis, May 1968. 91 p, 24 fig, 2 tab, 38 ref.

Descriptors: *Oxidation-reduction potential, *Phosphates, *Solubility, Anaerobic conditions, Aeration, Oxidation, Dehydration, Dissolved oxygen, *Activated sludge, Metabolism, Sulfates, Electrodes, *Waste water treatment.
Identifiers: *Orthophosphates, *Nutrient removal, Anoxic conditions, Lysis.

A series of seven experiments were performed to determine what factors were associated with the secretion of phosphate back into solution by activated sludge under anaerobic conditions. Various concentrations of Na2SO4 and MgSO4 were added to the mixed liquor. Oxidation-reduction potential (ORP) was mea,ured electrometrically, by means of platinum and saturated calomel electrodes. It was thought that phosphate release occurred as a function of a drop in the ORP , THEREFORE THE ADDITION OF THE SULFATE, CONTAINING CHEMICALLY BOUND OXYGEN, WOULD RAISE THE ORP and inhibit phosphate release. The factors which were closely monitored in an attempt to prove or disprove this theory were: (1) extent of phosphate uptake and release with aeration; (2) variation of the ORP; (3) corresponding phosphate release with and without addition of the sulfate salt. Results indicated anoxic release of orthophosphate depended upon adverse cell metabolism factors causing lysis, not on variation of the ORP. While sulfate salts in a 1% solution or less had no effect upon orthophosphate release, a 2% solution of MgSO4 accomplished a 46% reduction, presumably by a reduction in cell lysis rather than ORP manipulation. (Lowry-Texas)
W71-13321

REMOVAL OF GREASE AT A SECONDARY TREATMENT FACILITY,
Kansas Univ., Lawrence.
Carlos T. de Navarra, Jr.
Master's Thesis, University of Kansas, July 1967. 176 p, 43 fig, 18 tab, 53 ref.

Descriptors: *Sewage treatment, *Lipids, *Hydrolysis, Oxidation, Metabolism, Scum, Sedimentation, Biodegradation, Biochemical oxygen demand, Chemical oxygen demand, Fats Activated sludge, Acclimatization, Chromatography, Analytical techniques, *Waste water treatment, Kansas, Treatment facilities.
Identifiers: *Grease, *Sterols, Topeka (Kan), Floatation.

The Topeka, Kansas, activated sludge sewage treatment plant was studied in an attempt to elucidate the mechanism by which grease is removed during secondary biological treatment. Nine 24 hour composite samples and one 24 hour grab sample were analyzed and date accumulated on grease present in the influent, the sludge, and the effluent. Average grease concentration was 147 mg/l (.11 lb/cap.day). While both primary and secondary treatment removed significant amounts of lipids from their respective influents, only secondary treatment altered the relative proportion of the lipid classes. Grease removal efficiencies were 45% for primary treatment, 74% for secondary treatment, and 84% overall, while suspended solids removal efficiencies were 48% for primary, 69% for secondary, and 82% overall. Little, if any, relationship was observed between removals of grease and suspended solids in the primary clarifiers, the secondary system, or by complete treatment. (Lowry-Texas)
W71-13323

THE EFFECT ON THE EFFLUENT QUALITY OF AN ACTIVATED SLUDGE SYSTEM CAUSED BY SHORT PERIODS OF ANAEROBIC CONDITIONS IN THE AERATION TANK,
Kansas Univ., Lawrence.
Robert B. Barbour.
Master's Thesis, University of Kansas, August 1970. 71 p, 11 fig, 10 tab, 13 ref.

Descriptors: *Activated sludge, *Anaerobic conditions, *Aerobic conditions, Nitrification, *Aeration, Mixing, Dissolved oxygen, Bacteria, Rotifers, Protozoa, Chemical oxygen demand, *Waste water treatment, Effluents.
Identifiers: *Treatment efficiency, Suspended solids.

Observers in the field have from time to time recorded instances where an activated sludge unit became anaerobic for a short period of time with little or no effect on treatment efficiency. An attempt was made to duplicate these field conditions and determine just what amount of anaerobic action was limiting. However, difficulties were encountered in the setup of the experimental equipment. No attempt was made to model an existing facility, so the experimental unit experienced no flow variation and no non-uniform mixing. Because of the system design, the desired phenomenon could not be reproduced. Despite this fact several other interesting observations were made: (1) diffused aeration alone was not successful in providing both aeration and mixing in the unit used for this experiment; (2) treatment efficiency of a particular segment of a system appears to be dependent upon a certain residual dissolved oxygen concentration, below which the system becomes partially oxygen limiting, and (3) microscopic examination enabled the observer to obtain a approximation of the efficiency of the treatment system. (Lowry-Texas)
W71-13324

A STUDY OF SUBSTRATE UPTAKE AND BACTERIAL GROWTH KINETICS IN A DOMESTIC SEWERAGE SYSTEM,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
John R. Holloway.
Master's Thesis, June 1970. 60 p, 15 fig, 3 tab, 17 ref.

Descriptors: *Domestic wastes, *Aerobic bacteria, *Growth rates, Organic wastes, Kinetics, Biochemical oxygen demand, Trickling filters, Dissolved oxygen, *Waste water treatment, Virginia, Municipal wastes, *Bacteria.
Identifiers: Logarithmic growth, Declining growth, *Soluble organics, Food-to-microorganism ratio, Blacksburg (Virginia).

85 to 90% removals of soluble organic matter from domestic wastes, commonly obtained in conventional waste water treatment plants, may soon become insufficient because of increasing public awareness of water problems. Therefore, process optimization techniques must be applied in order to improve efficiencies, thereby improving percent reduction. For a process to be optimized, there must be a through understanding of the principles and mechanisms involved. Samples were taken from the Blacksburg-VPI sewage treatment plant pumping station, grit chamber, trickling filter influent, trickling filter effluent, and final effluent. Analysis of these samples revealed no extensive biodegradation of soluble organics during the one hour flow time from the pumping station to the grit chamber, probably on account of the absence of aerobic bacterial growth. It was then observed that bacteria can and do undergo both a log growth phase and a declining growth phase in a domestic sewerage system. Finally, analysis of the conventional decreasing rate BOD equation showed that while it closely approximated the bacterial oxygen uptake of domestic sewage in the declining growth phase, a modification to the equation was necessary to describe oxygen demand during the logarithmic growth period. (Lowry-Texas)
W71-13325

A LABORATORY EVALUATION OF THE PERFORMANCE OF THREE CELL OXIDATION PONDS IN SERIES,
Mississippi State Univ., State College.
Robert Jack Freeman, Jr.
Master's Thesis, May 1970. 91 p, 36 fig, 6 tab, 26 ref.

Descriptors: *Oxidation ponds, *Algae, Laboratory tests, Aerobic conditions, Anaerobic conditions, Organic loading, *Biochemical oxygen demand, Nitrogen, Phosphorous, Photosynthesis, Light intensity, Oxygenation, Denitrification, Oxidation, Adsorption, Coliforms, Bacteria, Centrifugation, *Waste water treatment.
Identifiers: *Detention time.

The relative ease with which the critical parameters could be varied prompted the use of laboratory scale equipment for evaluations of 3 cell oxidation ponds. 2 sets of 3 series ponds were used, once at a 300 lb BOD5/acre/day loading rate and a 2 day per pond detention time. Subsequent runs involved constant loading rates of 50 and 100 lbs BOD5/acre/days and detention times of 2,3, and 4 days per pond. A synthetic substrate, continuous flow loading, and controlled lighting were used. Both uncentrifuged and centrifuged samples were analyzed for BOD, total nitrogen, algal concentration, soluble orthophosphate, pH, and dissolved oxygen. For uncentrifuged samples, BOD, total nitrogen, and soluble orthophosphate removals ranged from 90 to 95%, 20 to 50% and 16 to 32% respectively. Centrifugation of the effluent for removal of the algae cells effected a 40 to 70% reduction of effluent BOD, a 25% to 40% reduction of total nitrogen in the effluent, while little or no reduction of soluble orthophosphate was observed. Also, at constant loading rate, varying detention times produced no effects on removals. A significant percentage removal of coliforms was obtained, but effluent coliform concentrations were still greatly in excess of acceptable standards due to the extremely high influent concentrations. (Lowry-Texas)
W71-13326

UPTAKE AND RELEASE OF SOLUBLE ORTHOPHOSPHATE IN AN ACTIVATED SLUDGE PLANT,
Marquette Univ., Milwaukee, Wis.
Richard M. Manthe.
Master's Thesis, April 1970. 62 p, 10 fig, 8 tab, 21 ref.

Descriptors: *Phosphates, *Absorption, Energy, Synthesis, Respiration, Metabolism, Dissolved oxygen, Biochemical oxygen demand, Aeration, Hydrogen ion concentration, *Activated sludge, Adsorption, Enzymes, Eutrophication, *Waste water treatment.
Identifiers: *Soluble orthophosphate, Mixed liquor, Suspended solids, Adenosine diphosphate, Adenosine triphosphate, *Orthophosphates.

Raw screened sewage and mixed liquor were obtained from the Milwaukee Sewerage Commission's Jones Island Sewage Treatment Plant. These samples were then used for batch tests to determine the effect of BOD, pH, aeration, time, settling time, D.O. concentration, mixed liquor suspended solids concentration, and various other operating parameters on the uptake and release of soluble orthophosphate. High soluble orthophosphate (SOP) removals indicated that the sewage and solids used were already acclimated for phosphorus removal. SOP uptake was fairly rapid during the first hour. At the end of 6 hours aeration, residuals of .2 mg/l P or less were obtained. pH fluctuations did not appear to effect either uptake or release of SOP, but the greatest rate of SOP removal was noted at the higher suspended solids concentration. While more SOP per cell mass was released at lower MLSS concentrations, the lesser number of cells resulted in less overall SOP released. Releases of SOP did occur in areas with low D.O. concentrations. These factors indicated that the phosphorus was used to generate ATP from ADP. The ATP was then stored and later utilized when other food was not available for energy source. The energy was used and the phosphorus released from the ATP resulting in cell respiration and ADP. (Lowry-Texas)
W71-13327

DISSOLVED AIR FLOATION OF A WHITE WATER WASTE,
Marquette Univ., Milwaukee, Wis.
Harikrishna Patel.
Master's Thesis, 1970. 59 p, 3 fig, 14 tab, 21 ref.

Descriptors: Pulp and Paper industry, *Industrial wastes, *Pulp wastes, Fibers (Plant), *Flotation, Coagulation, Flocculation, Sedimentation, Pressure, Temperature, Hydrogen ion concentration, *Waste water treatment.
Identifiers: *White water, Suspended solids, Polyelectrolytes.

White waters (wastes generated from paper machines and normally containing mainly fibers and fillers) were subjected to dissolved air flotation tests to determine the feasibility of flotation instead of conventional sedimentation. The waste water was subjected to a variety of different pressure, recirculation ratios, and chemical coagulants. Initial analysis revealed considerable construction cost savings, since flotation units occupy only one-sixth of the space needed for a comparably sized conventional sedimentation unit. In addition, flotation units could be prefabricated in the factory and assembled on the job, resulting in minimal time and expense. Alum and Ferric chloride were used as coagulants, and Anionic A-21, Separan NP-10, and guargum were used as polyelectrolyte conditioning aids. Trial and error produced a value of 30 psig as the optimum operating pressure, 21 individual tests were performed with alum. Removals of 94% were observed but taking average % removal the optimum dose was shown to be 40 mg/l and the removal was 90.8%. Similarly, each of the other chemicals was also tested 21 times. Optimum dose of ferric chloride was also 40 mg/l based both on operational and economic considerations. However, removal efficiencies with the aid of coagulants, using influents containing from 66 to 738 mg/l suspended solids, varied from 81.8% to 96.7%. Further examination showed the fibers to be moe discrete than colloidal, thus explaining why the coagulants showed little effect. No cost comparisons were presented between the conventional and the flotation systems. (Lowry-Texas)
W71-13328

THE RATE OF OXIDATION OF WASTE WITH THE ADDITION OF SUPPLEMENTAL CONSTITUENTS (NITROGEN AND PHOSPHORUS).
Ohio State Univ., Columbus.
Bernard R. Sacks.
Master's Thesis, 1967. 82 p, 38 fig, 24 ref.

Descriptors: *Sugar beets, *Industrial wastes, *Oxidation, Phosphates, Nitrates, Nutrients, Cells, Metabolism, Biochemical oxygen demand, Ammonium salts, *Waste water treatment, *Nitrogen compounds, *Phosphorous compounds, Nitrogen, Phosphorous.

A sugar beet waste was used to determine the effect of the addition of various types and amounts of nitrogen and phosphorus compounds. Since nitrogen and phosphorus are needed solely for the production of new cell material, then wastes already containing sufficient amounts of both would not be effected by addition of amounts in excess of that needed. It was discovered that nitrogen increased the rate of oxidation for a particular waste only if the oxidation time was less then four days. For wastes with oxidation times of greater than four days, the rate was concentration independent. Phosphorus was also shown to have a similar effect, but at a much lower level. Testing of types of material to be used showed that ammonium sulfate was both the most effective and the least expensive of compounds tested for nitrogen addition. Since sugar beet wastes were not phosphorus deficient, no similar testing for phosphate additions was possible. In each case, it was obvious that individual determinations must be made for each waste to establish the type of compound and the optimal amount to be used. (Lowry-Texas)
W71-13329

USE OF LIME-SODA ASH SOFTENING SLUDGE FOR THE TREATMENT OF MUNICIPAL WASTE WATER,
Kansas Univ., Lawrence.
Wayne E. Johnson.
Master's Thesis, University of Kansas, 1970. 45 p, 6 fig, 14 tab, 17 ref.

Descriptors: Water treatment, *Water softening, *Chemical precipitation, *Phosphates, Economic feasibility, Lime, *Sludge, Hydrogen ion concentration, Flocculation, Solubility, Chemical oxygen demand, Biochemical oxygen demand, Sedimentation, Dewatering, *Waste water treatment.
Identifiers: *Soda ash, Thickening, Suspended solids.

Disposal of lime-soda ash sludges from municipal water treatment plants is becoming increasingly more costly. Since recalcining is still too expensive to be justifiable, investigations were conducted to determine the feasibility of use the lime-soda ash sludge in waste water treatment to precipitate phosphates. Lime sludges from the Lawrence, Kansas water treatment plant were analyzed and found to contain 85% calcium carbonate and 4% magnesium hydroxide. About 400 to 600 mg/l of sludge could be added to the waste water, causing a rise of only one-half of a pH unit. In addition, the lime sludge tended to resist any pH change, requiring more supplemental addition of lime to raise the pH to 9.5, the optimum point for phosphate precipitation. No increase in suspended solids removals over conventional primary sedimentation was observed, soluble BOD and COD were not effected by either lime sludge or lime, and suspended BOD and COD removals were highly pH dependent. Therefore, economic analyses of individual situations must be conducted to determine whether the degreasing and thickening properties of lime sludge outweigh the cost of additional lime and use of apolymer for sludge thickening. (Lowry-Texas)
W71-13330

THE DEVELOPMENT OF PROCESS KINETICS FOR A WASTE TREATMENT SYSTEM UTILIZING FILAMENTOUS MICROORGANISMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
Hugh R. Edwards.
Doctoral Thesis, April 1970. 124 p, 32 fig, 7 tab, 53 ref.

Descriptors: *Activated sludge, *Fungi, Bacteria, Sludge, Nutrients, Organic loading, Hydrogen ion concentration, Chemical oxygen demand, *Biochemical oxygen demand, Neutralization, Acclimitzation, Toxicity, Nitrogen, *Waste water treatment.
Identifiers: *Filamentous microorganisms, *BOD-to-nitrogen ratio, Bulking, Suspended solids.

Filamentous organisms have long been nuisance in plants designed for conventional activated sludge treatment because of their poor settling characteristics. In this investigation, a treatment system was designed specifically for filamentous organisms. Advantages possessed by filamentous organisms included: (1) greater tolerance to pH changes (operated from pH 2.5 to pH 9.5); (2) lower nutrient requirements; (3) high surface to volume ratio, and (4) ability to operate under high BOD loading. Suspended solids, pH, BOD, COD, sludge production, and oxygen utilization changes were monitored to determine the effects of changes in flow rate, support media area, organic loading, pH and the BOD-to-nitrogen ratio. Both sludge production and oxygen utilization were found to be similar to values obtained from conventional activated sludge units treating organic wastes. The average value for 'a' on a total solids and COD basis, was 0.48, 'a' decreaased to 0.18, when the pH dropped to 2.60, and 'a' increased significantly for BOD:N ratios above the critical ratios. For pH 2.65 to 2.85, the critical BOD:N ratio was 45:1. For pH 6.6 to 7.45, the critical BOD:N ratio was shown to be 90:1. Removal rate was directly proportional to influent COD from 0 to 1200 mg/l. Sludge which sloughed off the support frame settled easily, eliminating the most important drawback of the unit. (Lowry-Texas)
W71-13331

THERMOPHILIC OPERATION OF ACTIVATED SLUDGE PROCESS,
Mississippi State Univ., State College, Dept. of Civil Engineering.
James E. Parker.

Master's Thesis, Department of Civil Engineering, August 1969. 78 p, 20 fig, 5 tab, 16 ref.

Descriptors: *Activated sludge, *Temperature, *Waste water treatment, *Organic matter, Oxygen, Thermophilic bacteria, Biochemical oxygen demand, Chemical oxygen demand, Sedimentation, Analytical techniques, Organic loading, Return flow, Separation techniques, Storage.
Identifiers: *Thermophilic process, Detention time.

The objective of activated sludge waste treatment of waste water is the removal and reduction of organic matter which takes up oxygen. One of the most likely means of doing this is thermophilic treatment, based on the treating ability of thermophilic microorganisms. The result would be evaluated in terms of BOD, COD, suspended solids removal, and effluent quality. The thermophilic process was evaluated at 55C, with a continuous flow system, under varying organic loading conditions and with solid separation and return. Sewage was collected every week at approximately the same time. After treatment in a fermentor, samples were acclimated for two weeks with sludge from a unit operated 54C. The first phase was designed to determine the effect varying the rate of flow of raw sewage and the detention time would have at 55C. The results showed that the laboratory activated sludge unit operated at 55C was capable of effecting an overall BOD reduction of 94% under varying organic loads. The final phase of the study dealt with the effect a 100% return of solids at varying flow rates and a constant detention time would have on the activated sludge treatment at 55C. Removal of BOD averaged 85% for the three runs done, with the overall BOD reduction being relatively constant for all the flow rates and for both filtered and non-filtered samples. The thermophilic process is capable of operating at a 100% solids return and effecting a high reduction in BOD. (Atkins-Texas)
W71-13332

AN INVESTIGATION OF AN UNUSUAL AERATION TANK FOAM,
Marquette Univ., Milwaukee, Wis. Dept. of Civil Engineering.
Richard R. Severin.
Master's Thesis, December 1970. 45 p, 3 fig, 7 tab, 24 ref.

Descriptors: *Microorganisms, *Activated sludge, Enzymes, Detergents, Oil, Foaming, Sewage treatment, *Aeration, Analytical techniques, Cultures, Chromatography, Suspension Wisconsin, California, *Waste water treatment.
Identifiers: *Actinomycetes, Nocardia corallina, Nocardia globerula, Nocardia opaca, Nocardia minima, Milwaukee, San Jose, Crisco oil.

A heavy growth of floating solids and microorganisms developed in an activated sludge treatment plant in Milwaukee. This foam was found to contain Actinomycetacae, Genus Nocardia as its principle microorganism, and could be found where mixed liquor or return sludge was being aerated. Vacuum skimming of aeration tanks and clarifier feed channels was used after regular defoaming agents failed. Recent introduction of enzyme detergents onto the market was considered a possible cause, and tests were conducted. A culture of the bacteria Nocardia was isolated from the mixed culture present in a sample of the surface growth. After isolation, a synthetic sewage containing a measured amount of enzyme detergent plus a known amount of grease was inoculated with the Nocardia and observed for the development of a surface growth. Six cultures were taken, fibe from the sewage plant in Milwaukee, and a second sample from a sewage plant in San Jose, California with similar foam. The addition of the enzyme detergent to the Nocardia failed to create the desired foam. Surface foam using pure cultures of Nocardia could be produced, but required unusually high concentrations of grease in the synthetic media. (Atkins-Texas)
W71-13333

PHOSPHOROUS EXTRACTION FROM SOLUTION BY HETEROGENOUS BIOLOGICAL SYSTEMS,
Maine Univ., Orono, Dept. of Civil Engineering.
Richard D. Rox.
Master's Thesis, University of Maine, January 1970. 67 p, 20 fig, 43 ref.

Descriptors: *Eutrophication, *Phosphorous, Algae, Nitrogen, Activated sludge, Chemical oxygen demand, Oxygen, Aeration, Dissolved oxygen, Hydrogen ion concentration, Settling, Microorganisms, Acclimation, Calcium, Sedimentation, Waste water treatment.
Identifiers: *Chemical-biological treatment, Mixed liquor, Suspended solids, Uptake.

Phosphorous has become the major controllable nutrient in the fight against eutrophication. An attempt has been made to find effective means of phosphorous removal through a chemical-biological treatment scheme. Bench scale activated sludge units of the phosphorous uptake and release by activated sludge systems. Soluble COD uptake, MLSS growth, oxygen utilization, initial F:M ratios and divalent cation concentrations were studied to determine their effect on removal. Phosphorous release was studied under extended periods of aeration, low concentrations of dissolved oxygen, quiescent settling conditions and low levels of pH. Activated sludge microorganisms were shown to produce reproduceable phosphorous uptake data while being acclimated to a synthetic waste. A phosphorous uptake of 0.02 pounds P/lb.COD/day was noted for bacterial cultures operating at several F:M ratios. A close correlation of the microbial oxygen utilization and the total soluble phosphorous uptake was observed. Phosphorus release was shown to be independent of dissolved oxygen concentrations and the period of aeration. Low pH conditions, however, showed significant levels of phosphorous secretion. Calcium added to the activated sludge mixed liquor showed varying degrees of enhanced phosphorous removal with no significant deterioration in biological activity. (Atkins-Texas)
W71-13334

THE MECHANISM OF PHOSPHOROUS REMOVAL IN ACTIVATED SLUDGE,
Maine Univ., Orono. Dept. of Civil Engineering.
Ralph E. Oulton.
Master's Thesis, University of Maine, January 1969. 87 pages, 31 fig, 20 ref.

Descriptors: *Eutrophication, *Algae, Nutrients, Nitrogen, Phosphorous, Nitrogen fixing bacteria, *Activated sludge, Storage, Temperature, Microorganisms, Nitrogen compounds, *Phosphorus compounds, Adsorption, Removal, Degradation, Chemical oxygen demand, *Waste water treatment.
Identifiers: Mixed liquor, Suspended solids, *Phosphorous uptake rate.

Compounds of nitrogen and phosphorous are the major nutrients in the eutrophication process. In order to control eutrophication, the supply of at least one of these nutrients must be controlled. Nitrogen-fixing bacteria offer a virtually unlimited supply of nitrogen to algae; therefore, phosphorus is the nutrient which can best be limited. Tests were made to determine whether the uptake of soluble phosphorous by activated sludge mixed liquor suspended solids is related to the variation in stored energy products within the cells comprising the MLSS. Results of the analytical tests performed revealed several facts, (1) An accidental increase in temperature from 25 deg C to 55 deg C caused an increase in the soluble phosphorous uptake rate from 40 mg/l to 80 mg/l, (2) removal of soluble phosphorus from solution is related to the continued metabolism of the activated sludge cells even after all available external energy sources are exhausted, (3) the first total soluble phosphorus concentration had no effect on the phosphorus uptake rate in the system studied, (4) the phosphorus removal and use of storage products after the exhaustion of external COD was independent of the first MLSS concentration and the temperature variations studied. (Atkins-Texas)
W71-13335

CORRELATION BETWEEN BOD, COD, AND TOTAL ORGANIC CARBON IN PAPER MILL WASTE,
Mississippi State Univ., State College. Dept. of Civil Engineering.
Charles T. Branch.
Master's Thesis, August 1969. 91 p, 24 fig, 13 tab, 30 ref.

Descriptors: Pulp and paper industry, *Waste water treatment, Biochemical oxygen demand, Chemical oxygen demand, *Pulp wastes, Carbon, Volatility, Analytical techniques, Sampling, Correlation analysis, *Industrial wastes, Hardwood, Mississippi.
Identifiers: International Paper Company, Vicksburg, Total organic carbon, Volatile solids.

The pulp and paper industry uses great amounts of water each day in the papermaking process. Increased concern about water pollution and wastewater treatment has brought about greater interest in a means of predicting the strength of wastes. One avenue for finding such a means might be through determining if an applicable relationship exists between the BOD, COD, and total organic carbon in mill effluent. Samples were taken from six types of waste from the International Paper Company's Vicksburg mill: (1) weak 'black liquor' from 'cooking', (2) discharge from the paper machine; (3) pulp and paper waste with settleable solids removed; (4) non-fibrous waste; (5) combinations of pulp and paper waste; (6) stored pulp and paper waste. The plant uses a kraft (sulfate) process. The various wastes were studied for BOD, COD, total solids, total volatile solids, inorganic carbon, and total carbon with samples being taken at two week intervals from late January to late April 1969. The nature of the instrument to determine total carbon made it necessary to concentrate several samples before laboratory tests were done. According to the results obtained, a correlation does exist between BOD, COD, and TOC of kraft pulp and paper mill wastes, although the degree depends upon the type of waste. It was also shown that wastes which remain fairly consistent in character were found to show more meaningful correlation of the characteristics studied. (Atkins-Texas)
W71-13336

NITROGEN AND PHOSPHOROUS REMOVAL IN CONVENTIONAL MUNICIPAL WASTEWATER TREATMENT PLANTS,
Mississippi State Univ., State College. Dept. of Civil Engineering.
William M. Bostwick, IV.
Master's Thesis, May 1970. 43 p, 20 ref, 6 tab.

Descriptors: *Waste water treatment, *Phosphorous, Municipal wastes, Activated sludge, Nutrient removal, *Nitrogen, Trickling filter, Waste treatment, Analytical techniques, Sampling, Pollution abatement, Microorganisms, Eutrophication, Biochemical oxygen demand, Chemical oxygen demand, Nitrates, Nitrites, Mississippi.
Identifiers: *Mississippi State University, Corinth, Booneville, Meridian.

Control of nutrient additions, especially phosphorous, is the best method of preventing surface water pollution by eutrophication. Four typical types of secondary waste water treatment were studied: (1) a fixed nozzle standard rate trickling filter plant, (2) high rate trickling filter plant, (3) a two-stage high rate trickling filter plant, and (4) a conventional activated sludge plant. The study sought to find a correlation between the BOD:P ratio in the raw sewage to organic efficiency and nitrogen and phosphorous removal. Samples taken from the four plants were tested for BOD, COD, soluble orthophosphates, ammonia nitrogen, organic nitrogen, nitrate nitrogen, and nitrite nitrogen. It was found that the mean total nitrogen

concentrations in the raw waste ranged from 26.9 mg/l to 34.8 mg/l with the mean soluble orthophosphate ranging from 13.2 mg/l to 23.7 mg/l. The mean concentration of soluble orthophosphate in the effluents was found to range from 10.4 mg/l to 23.9 mg/l with the mean total nitrogen ranging from 8.8 mg/l to 26.3 mg/l. The mean degree of soluble orthophosphate removal ranged from a slight increase to 19.6 percent while the mean total nitrogen removal ranged from 20.9 percent to 66.6 percent. (Atkins-Texas)
W71-13337

SANITARY AND TOXICOLOGICAL STUDIES OF THE PERMISSIBLE CONCENTRATION OF PHOSBUTYL IN WATER BODIES,
Moskovskii Gosudarstvennyi Meditskinskii (I) (USSR).
K. I. Docent Akulov.
Hygiene and Sanitation, Vol 35, No 4, April 1970. p 47-51, 1 fig, 3 tab.

Descriptors: *Organophosphorous pesticides, *Toxicity, Pesticides, Organoleptic properties, Taste, Color, Percolation, Run-off, Water quality control.
Identifiers: *Phosbutyl, *Median lethal concentration, *Cholinesterase activity, USSR.

Experiments with phosbutyl in water demonstrated that unfavorable organoleptic properties would cause rejection of a water supply before the concentration of phosbutyl was high enough to cause significant damage. The perception threshold for the odor is 0.03 mg/l, approximately 1/100 of the threshold concentration with respect to the sanitary conditions of a water body. At this level, phosbutyl has no detectable toxic effects. Median lethal doses for white mice, albino rats, and rabbits were 300 mg/kg, 390 mg/kg, and 150 mg/kg respectively. Long term experiments over an 8 month period were also performed. The principle effect of phosbutyl in low concentrations was shown to be inhibition of cholinesterase activity. Based on these and other analyses, the recommended maximum permissible concentration of phosbutyl was set at 0.03 mg/l. (Lowry-Texas)
W71-13340

SEVERAL METHODS OF ALGAE REMOVAL IN MUNICIPAL OXIDATION PONDS,
Kansas Univ., Lawrence.
Donald M. Martin.
Master's Thesis, University of Kansas, December 1970. 82 p, 22 fig, 6 tab, 19 ref.

Descriptors: *Oxidation lagoons, *Algae, Municipal wastes, *Filtration, *Filters, Biochemical oxygen demand, Chemical oxygen demand, Phosphorus, Nitrates, Ammonia, Coagulation, Flocculation, Sedimentation, Filtration, Lime, Rocks, Metabolism, Design criteria, *Waste water treatment, Effluents.
Identifiers: *Suspended solids, Sodium hydroxide, *Rock filters.

Effluent from an oxidation pond was collected and used both for a jar test and for runs through an upflow rock filter. A wide variety of coagulants and the new polyelectrolytes were used in the hope of discovering some economical means of removing algae from oxidation pond effluents. Lime, alum and sodium hydroxide were tested for use as flocculents, while Calgon's Cat-floc was used at a concentration of 8 mg/l as a flocculent aid. No cost figures were reported, but the addition of an extensive dosing, mixing, and sedimentation system, plus the fact that as much as 120 mg/l of flocculent would be required, indicated the process would defeat the main purpose of oxidation ponds, namely low cost and little or no maintenance. The rock filters, however, showed much more promise. Operated only by the hydraulic head of the pond level, the filters required no mechanical, electrical, or chemical equipment and little or no maintenance. Since COD was shown to be present both in dissolved and suspended forms, then the difference between soluble COD and total COD would indicate the efficiency of removal of suspended matter in the rock filter. On this basis, rock filters were shown to be capable of removing 80 to 90% of the suspended material COD. Further field scale tests were recommended for the establishment of operational parameters and design criteria. (Lowry-Texas)
W71-13341

ANAEROBIC DIGESTION OF THICKENED WASTE ACTIVATED SLUDGE CONTAINING IRON PHOSPHATES,
Marquette Univ., Milwaukee, Wis.
Alan G. Hartenstein.
Master's Thesis, October 1970. 101 p, 23 fig, 24 ref.

Descriptors: *Anaerobic digestion, *Phosphorous, *Iron, Precipitation (Chemical), Acclimatization, Organic loading, Hydrogen ion concentration, Alkalinity, Methane, Sludge, Analytical techniques, *Waste water treatment, Activated sludge, Sludge digestion.
Identifiers: *Waste pickle liquor, Volatile solids, Volatile acids.

Laboratory scale digesters were started up and were fed low-iron content sludge and brought to steady state. Digester No. 1 was then used as a control; digester No. 2 was fed a sludge containing 2% iron; and digester No. 3 was fed a sludge containing 5% iron. Performance effects were evaluated by comparison of: (1) quality and quantity of gas produced; (2) volatile solids reduction; (3) pH changes; (4) alkalinity; (5) % volatile solids changes in both the test digesters and the control. No changes were discerned in pH, alkalinity or volatile acids at either high or low loadings, while higher loading rates occasioned slight reductions in the per cent reduction of volatile matter. Gas production was also unaffected by iron in the sludge and was more or less independent of loading rate as well. No gas quality changes were observed at either the high or the low loadings. Total soluble phosphorus was released into solution on addition into the digester of sludges containing iron. The amount of release was directly proportional with both increases iron content of the feed sludge and increased loading rate. The control sludge, however, not only did not release any soluble phosphate, but showed definite uptake at higher loading rates. (Lowry-Texas)
W71-13342

FACTORS AFFECTING THE FILTRATION CHARACTERISTICS OF AEROBICALLY DIGESTED SLUDGE,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
David G. Parker.
Doctoral Thesis, December 1970. 128 p, 30 fig, 44 ref.

Descriptors: *Sludge treatment, *Aerobic conditions, *Dewatering, Activated sludge, *Digestion, Anaerobic conditions, Dissolved oxygen, Aeration, Hydrogen ion concentration, Temperature, Mixing, Chlorination, Metabolism, Coagulation, *Filtration, *Waste water treatment.
Identifiers: Suspended solids, Secretion.

Laboratory scale investigations were conducted to determine the chemical and biological mechanisms affecting sludge filterability, and also to establish the effects of aerobic digestion on the dewatering of activated sludge. The filterability of all sludges tested was improved with moderate aeration at 20 deg C. Optimum time for maximum filterability was found to be 4 to 6 day for activated sludge from plants without primary sedimentation. Differences in dissolved oxygen concentration above 2 mg/l produced little or no effect on sludge filterability. However, it was necessary to maintain the sludge in a viable active condition, since anaerobic conditions resulted in steady degradation of sludge filterability up to 4 days. Rapid mixing, chlorination before digestion, pH below 7.0 and low temperature all were found to depress sludge dewaterability, while pH above 7 and temperature above 30 deg C had little effect upon the system. The mechanism of filtration improvement appeared to be biological in nature, with extracellular polymeric substances being secreted by or exposed on the surface of bacteria during the endogenous phase of metabolism. These polymers caused coagulation and bridging between sludge particles, but only occurred when oxygen was present. Because of this phenomenon, the time required to drain 750 ml from a one liter sludge decreased by about 73% after 6 days of aeration, and total drainable water increased by 2%. (Lowry-Texas)
W71-13343

THE PRECIPITATION AND DISSOLVED AIR FLOTATION OF ORTHOPHOSPHATE USING FERROUS SULFATE AND CALCIUM HYDROXIDE,
Ohio State Univ., Columbus.
James F. Dietz.
Master's Thesis, 1969. 68 p, 13 fig, 31 ref.

Descriptors: *Phosphates, *Chemical precipitation, *Flotation, *Surfactants, Iron, Adsorption, Frothing, Sedimentation, Nutrients, *Waste water treatment, Water quality control.
Identifiers: *Dissolved-air-flotation, *Microflotation, *Orthophosphates, *Flotation.

Three different commercial surfactants: (1) CTAB- (Hexadecy tri-methyl ammonium bromide; (2) NaL- (sodium laurate); and (3) Duomac C- (N-COCO-1, 3 diaminopropane acetate) were used in testing a dissolved-air flotation phosphorus removal mechanism. The variables studied included the effect of pH range of the collector, the recycle ratio, and the molar ratio of phosphate to iron II. Comparison of this flotation system with that of microflotation was a primary objective of the study. Calculation of the air-to solids ratio for both systems revealed that a dissolved air flotation system with 50% recycle, could accomplish comparable removals with one fourth of the air required for a microflotation system. In addition, dissolved air flotation does not require the addition of a frothing agent which adds both to chemical and operational costs, as well as increasing the organic material in the effluent. Finally, the sludge volume produced by dissolved air-flotation was shown to be considerably less than that produced by conventional sedimentation. 98% phosphate removals were obtained by flotation with 20 ppm Puomac C in the pH range of 7-10; making it the best overall system, while optimum Fe:P ratio was found to be 2:1 for all surfactants, since competition for iron between hydroxide and phosphate ions occurs below that level. (Lowry-Texas)
W71-13344

ACTIVATED CARBON ADSORPTION OF TYPE I POLIOVIRUS FROM WASTEWATER,
Maine Univ., Orono. Dept. of Civil Engineering.
Warner Murray.
Master's Thesis, University of Maine, January 1968. 57 p, 11 fig, 2 tab, 48 ref.

Descriptors: *Viruses, *Water reuse, Bacteriophage, *Activated carbon, *Adsorption, Statistical methods, Analytical techniques, Isotherms, Chemical oxygen demand, *Tertiary treatment, Water purification, Water pollution sources, Pollution abatement.
Identifiers: *Poliovirus, Activated carbon adsorption beds, Nuchar C-190 Activated Carbon, Desorption, Virus exhaustion point, Chemical oxygen demand exhaustion point.

The burden being placed on our water supply due to increasing use of water resources, has brought about increasing interest in methods of water reuse. Such reuse calls for water which is entirely free of harmful pollutants, including viruses. One means of tertiary treatment which has been tested is the use of continuous-flow granular activated carbon ad-

sorption beds as a tertiary treatment procedure. A study was made in which polio type I virus was added to secondary effluent and passed through a column run beyond the virus exhaustion point. Three isotherm studies were also conducted in hopes of revealing the desorption phenomenon. Nuchar C-190 Activated Carbon in powdered form was used in the isotherm tests and a granular form of the same was used in the column tests. Results of the tests showed that: (1) the poliovirus exhaustion point is reached prior to the COD exhaustion point; (2) the quantities of poliovirus adsorbed had a mean value of 6.53 x 1,000,000 PFU per gram of carbon with a standard deviation of 2.70 x 1,000,000 PFU per gram of carbon; (3) a desorption and concentration effect of the poliovirus was noted after the virus exhaustion point was reached; (4) the polio virus that was adsorbed to, and desorbed from, the carbon was in no way altered in its ability to infect a host cell. (Atkins-Texas)
W71-13345

KINETIC STUDY FOR THE REMOVAL OF ORTHOPHOSPHATES FROM AQUEOUS SOLUTIONS USING ACTIVATED ALUMINA,
Northwestern Univ., Evanston.
Barry F. Winkler.
Master's Thesis, August 1969. 87 p, 27 fig, 14 tab, 39 ref.

Descriptors: *Kinetics, *Adsorption, *Phosphates, Diffusion, Films, Sampling, Ion exchange, Analytical techniques, Colorimetry, Spectrophotometry, *Waste water treatment, Aqueous solutions.
Identifiers: *Activated alumina, *Nitric acid, *Freundlich isotherm, Regeneration, *Orthophosphates.

A differential bed reactor was used to study the kinetics of phosphate removal by activated alumina. The interfering mechanisms, namely interparticle diffusion, film diffusion and pore diffusion, were studied and dealt with individually. Interparticle diffusion was avoided by diluting the alumina bed with glass beads of similar dimension. The effect of film diffusion was eliminated by operating at sufficiently high velocities, and pore diffusion was negated by using alumina of a mesh fine enough that no noticeable changes in reaction rates were observed for experiments where the particle size was the only variable. Effluent orthophosphate concentrations were determined colorimetrically. Spectrophotometric analyses were made at 710 micro, since a straight line Beers Law relationship was observed for varied sources of phosphates in the 0 to 30 mg/l range. An equation for the overall reaction mechanism was established which fit the Freundlich Isotherm. Therefore the removal mechansim was shown to be adsorption. This investigation also revealed that oven drying of the acid treated alumina was not necessary, and actually had a detrimental effect by driving of nitrate ions and reducing the number of available adsorption sites. Several promising regeneration schemes were also tested. Preliminary results, indicated that further work along both these lines may improve the economics of the process considerably. (Lowry-Texas)
W71-13346

EFFECT OF TEMPERATURE ON SUBSTRATE REMOVAL IN ACTIVATED SLUDGE,
Kansas Univ., Lawrence.
Christina Palmerlee.
Master's Thesis, University of Kansas, 1970. 84 p, 21 fig, 23 tab, 40 ref.

Descriptors: *Activated sludge, *Temperature, *Waste water treatment, Metabolism, Bacteria, Protozoa, Growth rates, Sludge, Acclimatization, Adsorption, Aeration, Chemical oxygen demand, Biochemical oxygen demand.
Identifiers: *Suspended solids, BOD5.

Both batch-fed and continuous feed activated sludge units were operated both at room temperature (22 deg C) and at 1-5 deg C. All other operational variables were held as nearly constant as possible. The substrates fed to the reactors were glucose and acetic acid-sodium acetate solutions. The operational cycle of the batch units consisted of 23 hours aeration, wasting of one liter of mixed liquor, one hour of sedimentation, wasting of one liter of supernatant, addition of feed and nutrients, adjustment of level with tap water, and then aeration again. The continuous fed unit was seeded with primary domestic sewage and substrate was added continually. Parameters monitored included mixed liquor volatile suspended solids, mixed liquor suspended solids, mixed liquor COD, effluent suspended solids, effluent and soluble COD and effluent and soluble BOD5. The data obtained demonstrated that conventional activated sludge systems operating under sustained low temperatues would require a longer aeration time to achieve removals comparable to those obtained at higher temperatures. In addition, low temperature operation also experienced difficulty in solids removals. Continuous-fed systems experienced less temperature 'shock' than batch fed systems, but solids removal difficulties were present for all low temperature operations. (Lowry-Texas)
W71-13347

DIGITAL SIMULATION OF ACTIVATED SLUDGE SYSTEMS,
Kansas Univ., Lawrence.
Ronald G. Conrad.
Master's Thesis, University of Kansas, June 1969. 115 p, 19 fig, 72 ref.

Descriptors: *Activated sludge, *Compter simulation, Digital computers, Analytical techniques, *Mathematical models, Data processing, Programming languages, Design criteria, Microorganisms, Mixing, *Waste water treatment, *Model studies, Simulation analysis.
Identifiers: *Algorithms, *Integration, Flow chart, Steady state, Transients, BASIC.

After an extensive literature review, the McKinney model of the activated sludge system was chosen for modeling on the digital computer. The programming language BASIC was chosen to allow running of the program on a time-share computer system, and also to allow operators with only minimal computer background to operate the program. Information flow between the parameter defining equations was constructed, and from this a basic algorithm for solution of steady state and transient state conditions was established. The program produced data which, upon analysis, revealed that McKinney's dF/dt equation did not correctly predict the value of F during the transient state. In addition the simulation model was limited in predicting the total response for systems subjected to transients, such as would occur in a full size operating system. The F/M ratio also was discarded as a parameter for determining the growth phase of a continuous system, since its value was not sufficiently defined. Graphical data output was found superior to tabular data in that it was more readily equated to operating characteristics. (Lowry-Texas)
W71-13348

A STUDY OF UPFLOW FILTRATION,
Kansas Univ., Lawrence.
Carl L. Hamann, Jr.
Master's Thesis, Kansas University, October 1969. 104 p, 10 fig, 24 tab, 49 ref.

Descriptors: *Filtration, *Water purification, *Turbidity, Separation techniques, *Coagulation, Sedimentation, Flow rates, Headloss, Depth, Temperature, Alkalinity, Hydrogen ion concentration, Coliforms, Sampling, Monitoring, *Waste water treatment, Kansas.
Identifiers: *Upflow filtration, *Biflow filtration, Suspended solids, Clarification, Fluidization, Lawrence (Kansas).

A laboratory scale upflow filtration system was constructed at the Lawrence, Kansas water treatment plant to determine the feasibility of purifying Kansas River water by combining coagulation and filtration in one high-rate process. Alum was injected into the raw water directly ahead of the filters, with coagulation and clarification to take place within the filter. The effects of both the rate of filtration and the depth of filter media on filter performance were studied, along with the effects of addition of a polymer to the alum coagulant. Filter runs were relatively short from a minimum of 2 hours to a maximum of 7 hours. Most runs were terminated either by bed lifting or fluidization. A 6 ft. depth filter without a grid system was shown to be capable of reducing effluent turbidity to 1.6 units, from influent turbidities varying from 260 to 140 units. Addition of a grid system to the top of the filters resulted in greater stability of operation, with longer filter runs and higher terminal head losses. The biflow filtration was also analyzed. Cost estimates showed a 15 to 30% savings in initial costs for biflow filters over conventional filters. No attempts were made to establish relative costs of any of the other systems. (Lowry-Texas)
W71-13349

ANAEROBIC DIGESTION OF THICKENED SLUDGE AT VARYING TEMPERATURES,
Mississippi State Univ., State College. Dept. of Civil Engineering.
Tommie G. Byrne.
Master's Thesis, August 1969. 105 p, 30 fig, 42 ref.

Descriptors: *Anaerobic digestion, *Activated sludge, Sewage treatment, Volatility, Temperature, Alkalinity, Acidity, Acids, Methane, Sedimentation, Hydrogen ion concentration, *Waste water treatment, Sludge treatment.
Identifiers: *Volatile acids, Acid formers, Methane formers, Sludge detention time, Total solids content.

Anaerobic digestion of activated sludge is one of the most complex methods of sewage treatment, as well as one of the most expensive. Many factors affect the digestion process: balance between methane formers and the acid formers, range of volatile acid concentrations, alkalinity concentration, sludge detention time, mixing method used, total solids content, loading rates, viscosity, and water content. In view of a recent finding that acceptable volatile solids reduction is possible from concentrated sludges, a need was seen to ascertain the effects of temperature on activated sludge. The study was done in two phases. During the first phase, a sludge of 15 percent total solids was digested at temperature of 105 deg F, 120 deg F, 130 deg F, and 140 deg F. Sludges of 5, 10, and 15 percent total solids were digested at 130 deg F during the second phase. Factors upon which the judging of the progress of digestion for the various sludges were based on total solids, volatile solids, ph, alkalinity, and volatile acids. Results of the study showed that temperature does have definite effects on the digestion of a thickened sludge. During this study, digestors operating at temperatures greater than 105 deg F showed distinct signs of impaired digestion as evidenced by high concentrations of alkalinity and volatile acids and extremely low production of gas. (Lowry-Texas)
W71-13350

BACTERIAL INNOCULATION OF A RAPID SAND FILTER FOR THE REMOVAL OF PHENOL,
Northwestern Univ., Evanston.
Joseph A. Cavalier.
Master's Thesis, ugust 1969. 55 p, 9 fig, 18 tab, 41 ref.

Descriptors: *Phenols, Taste, Odors, Biodegradation, Filters, *Bacteria, Pseudomonas, Temperature, Flow rates, Headloss, Chlorination, Water purification, *Waste water treatment.
Identifiers: *Biological filters, *Bacillus, *Flavobacterium, Inoculation.

Bacillus, Flavobacterium, and Pseudomas are among the bacteria reported in the literature as being able to degrade phenol biologically. Since Bacillus and Flavobacterium are also documented as being primary inhabitants of sand filters, a 3-inch diameter model sand filter was constructed for use in phenolic degradation studies. The filter was inoculated with 800 ml of a culture containing 10 to the 8th power bacteria/ml, and then subjected to several runs at a flow rate of 2 gpm/sq ft. In all runs, the filter was able to reduce the phenolic content from 10 p.p.b. in the nfluent to less than 1 p.p.b. in the effluent. The increase in headloss attributable to bacterial growth was less than 3 1/2 feet. In addition, the chlorine needed to kill the effluent bacteria, although rather high immediately following the inoculation of bacteria, was typical of doses needed for standard waste water effluents. The primary disadvantage of the system was that at 60 deg F, 1 1/2 days after inoculation were required to reduce the concentration to less than 1.0 p.p.b. from an initial 10 p.p.b. The process would have some promise for treating the persistent presence of phenol, but appears to be too slow for intermittent phenol problems. Preliminary results also showed higher temperatures, lower phenol concentrations and lower flow rates during inoculation could reduce the time required and the effects of these parameters, plus the effect of commonly used chemicals and back washing merit further investigation. (Lowry-Texas)
W71-13351

BIOLOGICAL TREATMENT WITH ROTATING FILTER,
Marquette Univ., Milwaukee, Wis.
Karen L. Van Aacken.
Master's Thesis, April 1968. 69 p, 15 fig, 2 tab, 43 ref.

Descriptors: *Biodegradation, *Slime, *Filtration, Filters, Microorganisms, Organic loading, Trickling filters, Activated sludge, Mixing, Aeration, Biochemical oxygen, demand, Chemical oxygen demand, Statistical methods, Acclimatization, *Waste water treatment, *Biological treatment.
Identifiers: *Rotating biological contactor, Hydraulic loading.

A rotating biological filter, combining the features of both the trickling filter and the conventional activated sludge process, in a laboratory model was constructed for testing purposes. An eight inch diameter, eighteen inch long drum was equipped with radially mounted window screening for media, set in a tank provided with scrapers made of screening, and rotated. Treatment occurred within the tank, with influent pumped in one end and effluent leaving through the other end. The effluent also carried the sloughed material with it. The Latin Square statistical analysis for variation was used to determine the governing parameters. Organic loading was shown to have the greatest effect on the system, while rate of rotation was a close second. Waste strength also affected efficiency, but to a lesser degree. 95% removal was obtained at a loading of 60 lbs BOD/1000 cu ft day, and 90% removal was observed at loadings of 250 lbs BOD/1000 cu ft/day at 5 to 7 rpm. Initial results were encouraging for further development, and scale up considerations were presented. (Lowry-Texas)
W71-13352

HIGH LEVEL INACTIVATION OF VIRUSES IN WASTE WATER BY CHLORINATION,
Maine Univ., Orono. Dept. of Civil Engineering.
Thomas L. Lothrop.
Master's Thesis, University of Maine, August 1968. 110 p.

Descriptors: *Water purification, *Chlorine, *Virus, *Bacteriophage, Storm run-off, *Chlorination, Pollution abatement, *Waste water treatment, Domestic wastes, Water pollution sources, Analytical techniques.
Identifiers: T2 bacteriophage, Type I poliovirus, *Poliovirus.

A study to determine the chlorine residuals required for a high degree of inactivation (99.99 percent) of viruses in waste water dealt with viruses in settled waste water, secondary effluent, and stormwater overflow. The waste water used in the tests was of a purely domestic nature, and the secondary effluent was from an extended aeration plant. Type I poliovirus and T2 bacteriophage were used. The first phase of the tests dealt with the inactivation of the T2 bacteriophage in settled waste water and secondary effluent. Results revealed that a combined chlorine residual of from 28.0 mg/l was required to inactivate 99.99 percent of the T2 phage in settled influent. In tests on the secondary effluent, a chlorine dosage of 4 to 6 mg/l produced a free residual of about .2 and .3 mg/l after the 30 minute contact time. These free residuals were found to effect a 1000 percent inactivation of the T2 phage according to the plaquing technique used. The second phase of the work utilized poliovirus. Eleven runs in settled waste water showed that combined residuals required for 99.99 percent inactivation ranged from 32.0 mg/l to 43.0 mg/l. The high level inactivation of the Type I poliovirus in secondary effluent and stormwater overflow was accomplished by providing breakpoint chlorination in the sample. It was found that a free residual of 0.2 to 0.5 mg/l would provide a 100 percent inactivation of the virus. (Atkins-Texas)
W71-13354

VIRUS INACTIVATION WITH PHOSPHATE REMOVAL IN A TERTIARY WASTE WATER TREATMENT PROCESS,
Maine Univ., Orono. Dept. of Civil Engineering.
Dirk R. Brunner.
Master's Thesis, University of Maine, August 1968. 82 p.

Descriptors: *Water purification, *Pathogenic bacteria, Virus, Water pollution sources, *Waste water treatment, Viruses, Bacteriophage, Calcium, Biochemical oxygen demand 5, Phosphate, Turbidity, Magnesium, Sedimentation, Isotherms, *Tertiary treatment.
Identifiers: T2 bacteriophage, Poliovirus Type I, Al (.....), Ca (....).

Possible solutions to the problem of water shortage are all based on elimination of pollution through identification and treatment of pollutants. One of the potential pollutants studied is pathogenic viruses which enter the environment through fecal discharges of man. Removal of these viruses is necessary for purification of water so that it can be reclaimed. A study was made of virus removal during phosphate precipitation with Al (.....) and Ca (....). Batch studies were performed in distilled water and filtered waste water treatment plant effluent with bacteriophage T2 and poliovirus Type I. Parameters investigated were phosphate, virus 5 day BOD, calcium, turbidity, magnesium, suspended solids, and pH. Investigations with Al (.....) in the two mediums indicated viruses were removed in large numbers with results following a Freundlich isotherm. It was found that the Al:PO4 mole ratio of 1.5 resulted in virus removals as great as 98.9 percent in waste water. Bacteriophage T2 and poliovirus could not be completely recovered from AlPO4 precipitate indicating chemical inactivation of 75% of the removed bacteriophage and 60% of the removed poliovirus. Investigation with Ca (....) in the two media resulted in removal of large numbers of poliovirus. Virus removals approached 95% at pH 11.0 in waste water. The best virus removals were obtained with formation of AlPO4. (Lowry-Texas)
W71-13355

A LABORATORY EVALUATION OF CHEMICAL COAGULATION AS A METHOD OF TREATING STABILIZATION POND EFFLUENT,
Mississippi State Univ., State College. Dept. of Civil Engineering.
Jerry Stewart.
Master's Thesis, August 1970. 73 p, 7 fig, 5 tab, 14 ref.

Descriptors: *Coagulation, *Waste water treatment, Analytical techniques, Coalescence, Flocculation, Liquid wastes, Separation techniques, Water purification, *Oxidation lagoons, Stabilization, Industrial wastes, Municipal waste, Biochemical oxygen demand, Chemical oxygen demand, *Phosphates, Nitrogen, Coliforms, Mathematical models, Algae, Sampling, Statistical methods.
Identifiers: *Aluminum sulfate, *Ferric chloride, *Ferric sulfate, *Stabilization ponds, Alum, Post-treatment.

A laboratory study was performed to evaluate the suitability of chemical coagulation as a post treatment method for effluents from waste stabilization ponds. The degree of effectiveness was measured in terms of biochemical oxygen demand, chemical oxygen demand, total phosphates, total nitrogen, coliform counts, and algal cell counts. Three coagulants: aluminum sulfate, ferric chloride, and ferric sulfate were evaluated. A mathematical model was constructed which allowed for the computation of the required dosage of coagulant for various influent and effluent concentration of phosphates. The results indicated that chemical coagulation with alum can be effectively used as a post treatment method of stabilization pond effluents. Nearly complete algae removal, over 90 percent BOD and phosphate removals, over 70 percent COD removals, and an average of 5,000 coliforms/1000 ml., were obtained using an alum dosage of 1000 mg/l. Settling characteristics of the alum-algae sludge were also investigated. (Atkins-Texas)
W71-13356

BIODEGRADABILITY OF ENZYME PRESOAKS BY ACTIVATED SLUDGE,
Marquette Univ., Milwaukee, Wis. Dept. of Civil Engineering.
Patricia P. Wesley.
Master's Thesis, May 1970. 82 p, 14 fig, 10 tab, 47 ref.

Descriptors: *Enzymes, *Detergents, *Activated sludge, *Biodegradation, Surfactant, Foaming, Alkylbenzene sulfonates, Linear alkylate sulfonates, Microorganisms, Chemical oxygen demand, Hydrogen ion concentration, Sludge digestion, Design criteria, Analytical techniques, Soaps, Water pollution sources, Suspension, *Waste water treatment.
Identifiers: Soap and detergent Association, Presoak, Interference, Methylene blue, Sludge bulking.

Enzyme laundry products can be divided into two classes: (1) enzyme detergents which are similar to regular detergents in chemical make-up and biodegradability; and (2) enzyme presoaks. Because of a lack of information on chemical composition, the biodegradability of presoaks is yet to be determined. Four major presoaks were tested for biodegradability by activated sludge waste treatment. The results of analytical tests performed showed that (1) three of the four major presoaks tested were biodegradable according to the ADA requirement of 90% reduction. The fourth averaged a reduction of 88%; (2) the activated sludge pH was not affected by continuous addition of a enzyme presoak, (3) sludge volume index decreased constantly with continuous addition of enzyme presoak, possibly due to sludge aging; (4) COD removal percentage decreased by an average of 7% with constant presoak addition; (5) microbial growth was not inhibited by the enzyme products; (6) addition of the presoak caused no sludge bulking, no filamentous growths, and no excessive foaming. Several individual problems with the presoaks occurred, such as interference in the Methylene Blue Surfactant Test for ascertaining surfactant removal, lower COD removal rate, and suspended solids in various individual tanks. (Atkins-Texas)
W71-13357

AN EVALUATION OF AN ANAEROBIC LAGOON TREATING SWINE WASTES,
Mississippi State Univ., State College. Dept. of Civil Engineering.
James H. Scarborough.
Master's Thesis, August 1970. 92 p, 24 fig, 8 tab, 44 ref.

Descriptors: *Farm wastes, *Hogs, *Anaerobic digestion, Slurries, Confinement pens, Farm management, Waste treatment, Sampling, Biochemical oxygen demand, Chemical oxygen demand, Phosphate, Hydrogen ion concentration, Alkalinity, Nitrogen, Sedimentation, Water pollution sources, Odor, *Oxidation lagoons, Waste water treatment.
Identifiers: New-light swine farm.

Interest in the treatment of livestock wastes has grown in recent years due to concentration of livestock in areas where they are raised for commercial use and the migration to urban areas of those who are seeking a less polluted habitat. In Mississippi, an aerobic lagoon which treated swine wastes was studied for quality of incoming waste and effluent, as well as performance under varying temperatures. Random grab samples of influent and effluent were taken approximately once a week from February 10 to April 23, 1970, and again on May 19, 1970. The samples were studied for biochemical oxygen demand, chemical oxygen demand, phosphorous expressed as phosphate, volatile solids, total solids, most probable number of coliform bacteria per 100 ml, alkalinity, and total nitrogen. Results showed that anaerobic lagoons would reduce the pollutional characteristics of the waste considerably. The lagoon still contained an appreciable amount of oxygen demanding material and still caused highly odorous conditions, indicating that the effluent should receive further treatment. Perhaps anaerobic lagoons should only be used as a preliminary step rather than a complete treatment facility and should be followed by other means of treatment prior to the adequate and safe disposal of the effluents. (Atkins-Texas)
W71-13358

EVALUATION OF PARAMETERS AFFECTING THE COLLOIDAL DESTABILIZATION OF SPENT VEGETABLE TANNIN LIQUOR,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
William A. Barkley.
Ph D. Dissentation, August 1970. 175 p, 28 fig, 23 tab, 135 ref.

Descriptors: *Industrial wastes, *Color, Pigments, Water analysis, Water pollution effects, Water properties, Water quality, Ions, Chemical oxygen demand, Temperature, *Waste water treatment, Electrochemistry, Water purification.
Identifiers: *Polyelectrolytes, *Tanning, *Aluminum sulfate, Tannin, Nalcolyte 675, Anionic polymers, Anions, Cations.

Processes for the treatment of spent vegetable tannin liquor must contend with many undesireable characteristics, primarily color. Reduction of the color with the chemical coagulants aluminum sulfate and polyelectrolytes was tested. Total volatile solids, tannin, and COD removal were found to be suitable parameters for the test, which also studied pH and the time interval between aluminum ion and polyelectrolyte addition. The problem of obtaining uniform characteristics in the waste products was solved by storing a large quantity of waste of typical properties at temperatures near 0 deg C. The method of reduction used to bring about the best results involved in the use of an aluminum ion-anionic polyelectrolyte chemical coagulation system. The best polyelectrolyte tested was a long chain anionic polymer, Nalcolyte 675. It was found that anionic polymers must be added after the aluminum sulfate with an interval of three to six minutes. The optimum pH for the aluminum-anionic polyelectrolyte system was 7, with a range of 5 to 7 being tested. Through the use of the system described, color removals approaching 90% were possible. (Atkins-Texas)
W71-13359

THE EFFECTS OF pH ON AEROBIC SLUDGE DIGESTION,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
Herbert Randolph Moore.
Master's Thesis, September 1970. 73 p, 25 fig, 30 ref.

Descriptors: *Aerobic treatment, *Activated sludge, Aeration, Protozoa, Biodegradation, Flocculation, *Sludge digestion, Sludge treatment, Organic wastes, Analytical techniques, Sewage treatment, Wastes, Sludge disposal, Biological treatment, Carbohydrates, Proteins, Solid wastes, Biochemical oxygen demand, Odor, *Waste water treatment, Hydrogen ion concentration.
Identifiers: Mixed liquors, Detention time.

Batch studies to determine the effects of pH on aerobic digestion of waste activated sludge were performed using a detention time of at least 20 days. Total and volatile solids reductions were not affected over a pH range from 3.5 to 9.5. Somewhat greater solids reductions were realized when pH was held constant rather than allowed to vary as occurs with normal aerobic digestion. High reductions in mixed liquor BOD were consistent among digesters over the pH range investigated; however, sludge digested 23 days at pH 9.5 developed as objectionable odor when aeration was discontinued for 24 hours. Cellular carbohydrates and cellular protein accumulated during digestion, but no distinct relation to pH level was obvious although cellular carbohydrate showed a slightly greater accumulation with lower pH. Striking improvement in the settleability, drainability, and filterability of sludge digested at pH 3.5 occurred. This effect was attributed to the development of an overwhelming protozoan population which caused observable improvement in the flocculation characteristics of the sludge. (Atkins-Texas)
W71-13360

EFFECT OF POWDERED ACTIVATED CARBON ON COAGULATION WITH ALUM,
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
Raymond Dubois Letterman.
Master's Thesis, June 1969. 56 p, 14 fig, 28 ref.

Descriptors: *Activated carbon, *Coagulation, *Sewage treatment, Slurries, Solid wastes, *Waste water treatment, Water purification, Analytical techniques, Activated carbon, Suspensions, Alkalinity, Turbidity, Water properties, Water quality, Hydrogen ion concentrations, Carbon, Clay minerals, Silicates.
Identifiers: *Jackson turbidity unit, Aluminum sulfate, Alum, Kaolin.

The effect of several variables on the coagulation of powdered activated carbon suspensions with aluminum sulfate was studied. The variables included the concentrations of activated carbon and initial bicarbonate alkalinity, and pH. It was ascertained that increased carbon concentrations increased the alum dose required to produce a residual turbidity of 1 JTU. The alum dose required to produce a specific percent turbidity removal varied depending on the reference turbidity used to calculate the percent turbidity removal. The pH at which a minimum alum dose produced a given turbidity removal decreased with increased bicarbonate alkalinity concentration. This minimum alum dose also decreased with increased bicarbonate concentration. The alum dose required to produce a residual turbidity criteria of 1 JTU decreased no more than 1 mg/l when carbon concentrations from 5 to 25 mg/l were mixed and coagulated with various dilute kaolin suspensions. The alum dose required to produce a 50% turbidity removal based on the final turbidity of an untreated suspension decreased significantly when carbon was added to the kaolin suspensions. (Atkins-Texas)
W71-13361

STATE AND LOCAL PRACTICES IN SOLID WASTE MANAGEMENT,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
Robert Bradley Chewning.
Master's Thesis, August 1970. 60 p, 14 tab, 11 ref.

Descriptors: *Solid wastes, *Legislation, Waste treatment, Waste disposal, Administration, Planning, Water resources, Water policy, Federal government, Local government, State government, Standards, Project planning, Management, Research and development, Ultimate disposal, Operation and maintenance, Training, Leadership, Scientific personnel.
Identifiers: *Solid wastes disposal Act of 1965.

Prior to 1965, there was essentially no Federal or State program in existence to provide assistance or surveillance of solid waste practices. The Solid Waste Disposal Act of 1963 established the Federal Solid Waste program and has provided encouragement to the state to initiate solid waste programs. Only five states were found lacking in legislation or planned legislation on solid waste at the time of the study. Data on the local and national levels revealed that many community solid waste programs are deficient in planning and operation. Public officials are concerned over problems which are faced in management of solid waste treatment systems. In most instances, they are hindered in planning and instituting effective programs by lack of training in solid waste treatment. Strong programs in solid waste are needed by the state to improve the deficiencies that exist in current solid waste practices. While most of the states now have solid waste laws, in most cases the enabling legislation and funding are not adequate to provide the technical assistance and leadership needed at the local level. (Atkins-Texas)
W71-13362

STATISTICAL ANALYSIS OF TRICKLING FILTER DESIGN EQUATIONS,
Northwestern Univ., Evanston, Ill.
M. H. Eltarifi.
Master's Thesis, August 1969. 57 p, 14 fig, 8 tab, 33 ref.

Descriptors: *Statistical methods, *Trickling filters, Efficiencies, Correlation analysis, *Regression analysis, Mathematical models, Digital computers, Depth, *Waste water treatment.
Identifiers: *Recirculation factor, *Hydraulic loading.

A literature review was conducted and seventy-five observations of trickling filter performance were selected. These random samples were then subjected to multiple regression and correlation analysis program BMD29. The primary variables determining trickling filter performance were assumed to be depth, recirculation ratio, and hydraulic loading. The multiple correlation coefficient for every equation was calculated, each coefficient being an estimate of the association between the different variables. A simplified formula was proposed and demonstrated to be very compatible on reliability and simplicity in predicting the efficiency of trickling filters. The equation is E— (12.4) (D0.71) (F0.73)/ (Q0.16), where E— filter efficiency, D— filter depth in feet, F— recirculation factor, and Q— hydraulic loading in GPM/ft sq. When Q is expressed in MGAD, the constant 12.4 must be changed to 6.4. The multiple correlation coefficient is 0.825. (Lowry-Texas)
W71-13363

KINETICS OF SLUDGE WASTING IN EXTENDED AERATION PROCESSES,
Nova Scotia Technical Coll., Halifax.
Esbon Anthony Ross.
Master's Thesis, April 1970. 117 p, 33 fig, 10 tab, 36 ref.

Descriptors: *Activated sludge, *Biodegradation, Microorganisms, *Aeration, Hydrogen ion concentration, Dissolved oxygen, Organic loading, Design criteria, Kinetics, Sludge, Sedimentation, Sampling, *Waste water treatment, *Sludge treatment.
Identifiers: *Extended aeration, *Auto-oxidation, Aerobic digestion, Mixed liquor suspended solids.

Three laboratory scale extended aeration activated sludge units were constructed with (1) to have no sludge wastage, (2) to have daily wastage of sludge buildup in excess of the starting volume, and (3) to have weekly wastage of sludge in excess of the starting volume. The units were fed a synthetic sewage prepared from dry milk, water, and dog food. After a 30 day acclimatization period, two test runs, one of 48 days duration and the second of 55 days duration, were conducted. It was determined that laboratory scale units are able to operate under organic loadings not in excess of 15 lb/day/1000 cu ft of aeration tank volume for long periods of time without wasting sludge. Very little maintenance was required, and DO and pH measurements were found to be adequate indicators of plant performance. 2 1/2 hour sedimentation time was sufficient for a mixed liquor containing healthy microorganisms, whereas overly long sedimentation periods were detrimental in that eutrophication could occur as a result of sludge anaerobiosis. Frequent wasting did not effect either BOD or SS removal capacities, since most of the builtup solids were mainly non-biodegradable material. Although preliminary results were excellent, larger scale studies must be performed before actual operating feasibility can be determined. (Lowry-Texas)
W71-13364

PHOSPHATE REMOVAL BY ACTIVATED SLUDGE FLOC,
Marquette Univ., Milwaukee, Wis.
Raj Kumar Aggarwal.
Master's Thesis, March 1970. 81 p, 8 fig, 69 ref.

Descriptors: *Phosphorous, *Activated sludge, Separation techniques, Chemical precipitation, Calcium, Metals, Storage, Aeration, Biochemical oxygen demand, *Waste water treatment, *Sludge treatment.
Identifiers: *Biological incorporation, Mixed liquor suspended solids, Sludge volume index.

The percentage of phosphate removed by activated sludge has been reported as varying between 20 and 50%. A 20 liter laboratory activated sludge unit was assembled and fed two different synthetic feed solutions. Return sludge was obtained from a municipal sewage treatment plant. Biological incorporation of phosphate was shown to account for only 2.7 to 2.9% P as based on sludge volatile matter, resulting in an average 9.43% phosphate removal. Initial high phosphorous removals were attributed to high iron content of the sludge and the presence of soluble calcium in the mixed liquor. Phosphorous incorporated biologically using both normal sludges and phosphorous-starved sludge was the same. Complete P removal was demonstrated using P-starved return sludge when a 7 to 13 mg/l P and 200 to 300 mg/l COD synthetic waste water was fed. Addition of metallic ions, such as calcium, enhanced the storage capacity of the cell mass for P, but also decreased the volatile solids content of the sludge. Changes in the MLSS level or the initial substrate concentration had no detectable effect on P uptake. The use of the P-starved sludge was recommended, with metallic ion addition requiring further study. (Lowry-Texas)
W71-13365

OPERATIONAL AND ENVIRONMENTAL FACTORS AFFECTING ACTIVATED SLUDGE PHOSPHATE RELEASE,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
B. S. Hulcher.
Doctoral thesis, May 1970. 128 p, 53 fig, 5 tab, 40 ref.

Descriptors: *Activated sludge, *Phosphates, Stress, Microorganisms, Hydrogen ion concentration, Acid, Aeration, Dissolved oxygen, Salts, Aerobic conditions, Anaerobic conditions, Solubility, Osmotic pressure, *Waste water treatment, *Biological treatment.
Identifiers: *Orthophosphate release, Mixed liquor suspended solids, Mixed liquor volatile suspended solids, *Lysis, Activated alumina.

Phosphate release from activated sludge occurs for two primary reasons, lysis of cells and secretion of material from cells which have had their cytoplasmic membrane altered, making the release a biological phenomenon. Both lysis of cells and alteration of the cytoplasmic membrane are caused by environmental stress on the cells as determined by laboratory scale batch testing. This stress may result from the onset of anaerobic conditions, from pH change, or from production of acid or alcohol end products. Phosphate release is linear with MLSS concentration but is an increasing function of MLVSS. However, the presence of organic substrate remaining at the end of the aeration period retards orthophosphate release by making energy available to the cell and retarding the death rate. Stress effects and subsequent releases may also be produced by chemical additions such as NaCl. Activated alumina was tested and found to possess desirable qualities for the removal of phosphate from wastewater with little or no effect on the subsequent oxygen uptake rate of the microorganisms. (Lowry-Texas)
W71-13366

ANAEROBIC DIGESTION OF CHEMICALLY PRECIPITATED SLUDGE,
Marquette Univ., Milwaukee, Wis.
Thomas P. Parrillo.
Master's Thesis, August 1970. 82 p, 22 fig, 2 tab, 34 ref.

Descriptors: *Anaerobic digestion, *Phosphates, *Chemical precipitation, Eutrophication, Sludge, Temperature, Alkalinity, Hydrogen ion concentration, Iron, Methane, Carbon dioxide, Nitrogen, *Waste water treatment.
Identifiers: *Volatile solids reduction, *Alum.

Chemical precipitation of phosphates with alum and iron salts has been suggested as a method of combatting eutrophication of lakes. The sludges thus formed are bulky and difficult to handle. Three laboratory digesters mixed by gas recirculators were operated at a controlled temperature of 95 plus or minus 2F and brought to steady state on normal primary sludge. Two of the digesters were then fee chemically precipitated sludge while the third served as a control. The quantity and quality of gas produced, the volatile solids reduction, and pH changes were monitored and compared for all three digesters. Total soluble phosphorous was monitored both in the feed and in the digested sludge to determine if any release of phosphorous was taking place. These investigations revealed that: (1) chemically bound phosphorous was not released during anaerobic digestion; (2) no drastic effect on digester performance was observed except the inhibition of gassification in the units fed chemical sludge; (3) CO_2 content was lower while N_2 content and methane content were higher in gas produced from the chemical sludge; and (4) no adverse effects on pH or volatile matter destruction were observed. (Lowry-Texas)
W71-13367

THE ROLE OF IRON IN PHOSPHATE ADSORPTION ON COAL,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
F. R. McNeice.
Master's Thesis, August 1968. 70 p, 19 fig, 4 tab, 21 ref.

Descriptors: *Phosphates, *Coal, *Adsorption, Chemical precipitation, Iron Laboratory tests, Kinetics, Eutrophication, Nutrients, Hydrogen ion concentration, Tertiary treatment, *Waste water treatment, *Water purification.

The coal contact process for phosphate removal was studied on a laboratory batch scale. Phosphate adsorption rate differences were determined as a function of both coal type and pH. High volatile Bituminous A, High Volatile Bituminous C, Medium Volatile Bituminous, and low volatile Bituminous coals were all tested, with High Volatile Bituminous C exhibiting a substantially higher degree of phosphate adsorption at pH between 5.0 and 6.0. The 5.0 to 6.0 pH range was also found to be the range in which the adsorption mechanism was least reversible. Under these optimum conditions, one gram of High Volatile Bituminous C adsorbed more than 15 mg/l of phosphate from a 100 ml volume of 20 mg/l phosphate solution. Results from further work indicated that the adsorption apparently was achieved by the reaction of phosphate ions and the ferric ions contained in the coal, leading to the formation of insoluble ferric phosphate. (Lowry-Texas)
W71-13368

EFFECT OF BIOLOGICAL PRETREATMENT ON THE LIME DEMAND OF DIGESTER SUPERNATANT LIQUOR,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
J. M. Glennon, Jr.
Master's Thesis, September 1966. 68 p, 14 fig, 4 tab, 27 ref.

Descriptors: *Lime, *Waste water treatment, *Chemical precipitation, Sedimentation, Alkalinity, Hardness (Water), Calcium carbonate, Biochemical oxygen demand, Phosphates, Oxidation lagoons, Aeration, Biodegradation, Pilot plants, *Biological treatment.
Identifiers: *Digester supernatant liquor, *Aerated lagoons, Suspended solids.

Supernatant liquor from sludge digestion contains large amounts of BOD, alkalinity and phosphates. Recirculation through the plant, although widely practiced, may cause overloading of the plant with a resulting high BOD and phosphorous level in the effluent. Lime treatment will reduce the suspended solids, BOD, phosphates, and alkalinity, but amounts necessary are prohibitively expensive. The effect of biological treatment on lime demand of the effluent from a batch operated aerobic lagoon treating digester supernatant was studied. Pilot plant effluent, after various periods of aeration, but aeration in excess of 2 days produced no further effect. After two days aeration, however, 5-day BOD, suspended solids, total alkalinity, and total hardness were reduced by 85%, 97%, 50% and 58% respectively at pH 11.0 using the decreased lime dosage. In addition, sedimentation of the lime treated effluent was complete within one hour. (Lowry-Texas)
W71-13369

STORM WATER MANAGEMENT MODEL,
Metcalf and Eddy, Inc., Palo Alto, Calif., and Florida Univ., Gainesville. Dept. of Environmental Engineering; and Water Resources Engineers, Inc., Walnut Creek, Calif.

Available from GPO in paper copy as EP 2.10:11024 Doc 07/71 Vol I-2.75, Vol II-$1.50, Vol III-$2.75, Vol IV-$2.00, Also Available from NTIS in microfiche as PB-203 289 Vol I, PB-203 290 Vol II, PB-203 291 Vol III, and PB-203 292 Vol IV. EPA Report No 11024 Doc 07/71. 1031 p, 90 ref. EPA Contract Nos. 14-12-501, 502, 503.

Descriptors: *Water quality control, *Computer model, *Storm water, Simulation analysis, Rainfall-runoff relationships, Sewerage, Storage, Waste water treatment, Cost benefit analysis.
Identifiers: Combined sewer overflows, Urban runoff.

A comprehensive mathematical model, capable of representing urban storm water runoff, has been developed to assist administrators and engineers in the planning, evaluation, and management of overflow abatement alternatives. Hydrographs and pol-

lutographs and management of overflow abatement alternatives. Hydrographs and pollutographs (time varying quality concentrations or mass values) were generated for real storm events and systems from points of origin in real time sequence to points of disposal (including travel in receiving waters) with user options for intermediate storage and/or treatment facilities. Both combined and separate sewerage systems may be evaluated. Internal cost routines and receiving water quality output assisted in direct cost-benefit analysis of alternate programs of water quality enhancement. Demonstration and verification runs on selected catchments, varying in size from 180 to 5,400 acres, in four U.S. cities (approximately 20 storm events, total) were used to test and debug the model. The amount of pollutants released varied significantly with the real time occurrence, runoff intensity duration, pre-storm history, land use, and maintenance. Storage-treatment combinations offered best cost-effectiveness ratios. A user's manual and complete program listing were prepared.
W71-13370

METAL TOXICITY TO SEWAGE ORGANISMS,
Calvin P. C. Poon, and Kran H. Bhayahi.
Journal, Sanitary Engineering Division, Proceedings, of the American Society of Civil Engineers, Vol 97, SA 2, April, 1970, p 161-169, 2 fig, 1 tab, 5 ref. OWRR A-033-RI (1).

Descriptors: *Activated sludge, *Sewage bacteria, *Toxicity, Fungi, *Metals, Chromium, Copper, Kinetics, Enzymes, Laboratory tests, Waste water treatment, Water pollution effects.
Identifiers: *Geotrichum candidum, Silver, Nickel, Zinc.

Separate cultures of Geotrichum candidum and sewage bacteria were subjected to shock loads of such toxic matals as copper, nickel, zinc, silver, and chromium. It was discovered that the MICHAELIS—Menten model of enzyme inhibition, although of great utility when dealing with pure culture and pure substrates, had little application to mixed cultures receiving mixed substrates. The determination of enzymic mechanisms with more than one substrate and product was pursued utilizing rate equations outlined by Cleland. It was demonstrated that of the metals tested, silver and nickel are less toxic to Geotrichum candidum than to sewage bacteria. This lesser susceptibility caused G. candidum to be the organism for which growth conditions were more optimum, and, especially in high flow systems where weaker organisms get washed out, G. candidum would predominate. Therefore, overgrowths of G. candidum, and their associated bulking problems, have been successfully linked, at least partially, to metal toxicity. (Lowry-Texas)
W71-13404

REMOVAL OF METALS BY CHEMICAL TREATMENT OF MUNICIPAL WASTE WATER,
Boliden Reymersholmsverken Research Lab., Halsingborg (Sweden).
Rolf Nilsson.
Water Research, Vol 5, No 2, February 1971, p 51-60, 3 fig, 9 tab, 3 ref.

Descriptors: *Heavy metals, *Toxicity, *Metals, *Municipal wastes, Chemical precipitation, Biodegradation, Sedimentation, Separation techniques, Biochemical oxygen demand, Chelation, Organic loading, Calcium hydroxide, Adsorption, Detergents, Phosphorus, *Waste water treatment.
Identifiers: Aluminum sulfate, Lead, Mercury, NTA, *Chemical treatment.

Increasing levels of metal ions which are toxic to aquatic life have resulted in much research concerning methods of metal ion removal. Chemical treatment, both with aluminum sulfate and clacium hydroxide was investigated in laboratory scale experiments to determine the extent to which metal ions were removed. Tests were proformed on water both with and without NTA to determine what effect NTA might have. From these investigations it was determined that Pb (II), Cu (II), Cr (III), Hg (II), Cd (II), and As (V) can be reduced to levels below the accepted standards with both Aluminum Sulfate and calcium hydroxide at pH 9.5 and 6.5-7.0 respectively. Zr (II), Ni (II), and Co (II), were precipitated only at pH values A or — 9.5. In the presence of NTA, Cu (II), Ni (II), and Pb (II) were able to form complexes and pass through the treatment system unharmed. Such complexes were also shown to be extremely resistant to biodegradation. It was demonstrated that even with adequate biological and chemical treatment, metals complexed with NTA could still pass through into receiving waters. However, as long as NTA is not present, then combination biological and chemical treatment plants complement one another and provide effective treatment. (Lowry-Texas)
W71-13405

WASTEWATER RECLAMATION IN A CLOSED SYSTEM,
Ontario Research Foundation, Toronto. Dept. of Engineering.
F. Besik.
Water and Sewage Works, Vol 118. No. 7, July 1971, p 213-219, 2 fig, 10 tab, 52 ref.

Descriptors: *Water reuse, *Domestic wastes, *Recirculated water, Adsorption, Reverse osmosis, *Coagulation, Chemical precipitation, Oxidation, Aeration, Disinfection, Taste, Odors, Alkalinity, Hardness, Nutrients, Hydrogen ion concentration, Activated carbon, Cost analysis, Water treatment, *Waste water treatment.
Identifiers: *Closed water-wastewater treatment system, Air stripping.

A closed water-wastewater treatment system was assembled from components presently available. The first step was coagulation-clarification for the removal of suspended solids with the parallel removal of phosphates. Lime and alum were found suitable for use as primary coagulants, with or without polyelectrolyte coagulant aids. Next, air stripping was empolyed to remove solvents (such as acetone, methylethylketone, and other low molecular weight hydrocarbons), volatile gases (hydrogen sulfide, methane, carbon dioxide, chlorine, and ammonia), and their associated tastes and odors. Hardness and organic carbon are also removed to a certain extent. Reverse osmosis, units are than used to provide 90 to 98% removal of divalent ions and 70 to 90% removals of nonovalent ions. Remaining material was than shown to consist mostly of monovalent ions (sodium, potassium, chloride, nitrates, etc.) and low molecular weight organics. Effluent from the reverse osmosis units was chemically oxidized with ozone and subjected to carbon adsorption polishing. Cost estimates revealed a 55% initial cost savings and a 45% yearly operational savings for a closed system as opposed to conventional separate water treatment facilities. (Lowry-Texas)
W71-13406

A STUDY OF MEAT PACKING AND RENDERING WASTES,
Wayne State Univ., Detroit, Mich.
Henry A. Dirasian.
Water and Wastes Engineering, Vol 7.5, May 1970, p C 16-C 20, 2 fig, 2 tab, 2 ref.

Descriptors: *Laboratory tests, *Industrial wastes, *Flotation, Pressure, Scum, Biochemical oxygen demand, Chemical oxygen demand, Hydrogen ion concentration, Temperature, Separation techniques, *Waste water treatment.
Identifiers: *Grease, Suspended solids, Volatile solids, Recirculation ratio, Detention time, *Meat packing wastes, Rendering wastes.

A laboratory scale flotation unit was designed to treat the effluent from a meat rendering and packaging plant. Samples of the effluent were obtained both on a rigid time table and on a grab basis, and analyzed for grease and COD. More infrequent analysis included BOD, total solids, suspended solids, volatile solids, and pH. Average waste temperature was 24C. A number of flotation aids, including alum, FeC13, FeSO4, and others were tested. It was determined that alum provided the best flotation. 13 tests were then conducted using the plant effluent in the flotat ion unit. The unit was operated at a recirculation ratio of 4:1 with a 20 minute holding time. Various alum doses were added to different grease concentrations and removals in excess of 98.5% were attained in 2 of the 13 tests, demonstrating the desirability of performing larger scale testing for the purpose of determining design parameters. (Lowry-Texas)
W71-13407

WASTE DISPOSAL IN THE MEAT INDUSTRY 2,
A. J. Steffan.
Water and Wastes Engineering, Vol. 7.5, May 1970, p C1-C4 3 fig, 3 tab, 18 ref.

Descriptors: *Oxidation lagoons, *Biodegradation, *Anaerobic conditions, Aerobic conditions, Organic loading, Biochemical oxygen demand, Oxygenation, Percolation, Sedimentation, Scum, Methane, Digestion, Sludge, Industrial wastes, Waste disposal, Tennessee, Waste water treatment, Waste disposal.
Identifiers: Aerated lagoons, *Meat packing wastes, Union City (Tenn).

Anaerobic lagoons, aerobic lagoons, aerated lagoons, extended aeration lagoons, facultative lagoons, and many combinations of these types are all currently being used in the meat processing industries. Analysis of the various installations revealed that anaerobic ponds operated at Union City, Tennessee, produced an 80% BOD removal at a loading in excess of 15 lb BOD/1000 ft3. Data from 29 other ponds revealed BOD loadings of from 175 to 6060 lbs BOD/acre/day with removals of from 65 to 95%. Data on 50 aerobic pond systems without supplemental aeration revealed a median loading of 72 lb BOD/day/acre, median depth of 3 ft, median area of 1.3 acres, and 70 days detention time. Bothe dilute and concentrated wastes can be treated. Similar data is reported for anaerobic-aerobic systems, and three-pond systems. Single case studies are also reported for the anaerobic contact process. (Lowry-Texas)
W71-13408

ANALYSIS OF ACTIVATED SLUDGE SEPARATION PROBLEMS,
Northwestern Univ., Evanston, Ill.
Jerry A. Nathanson.
Master's Thesis, September 1968, 47p, 3 fig, 5 tab, 22 ref.

Descriptors: *Sludge, *Sampling, *Statistical methods, Microorganisms, Molds, Classification, Separation techniques, Alkalinity, Hydrogen ion concentration, Temperature, Particle size, Dissolved oxygen, Organic loading, Chemical oxygen demand, *Waste water treatment.
Identifiers: *Filamentous bacteria, *Bulking, Sludge volume index, Settling characteristics.

Sixty sludge samples were collected from 18 operational treatment plants over a period of 2 years. The samples were classified as normal, bulking, pin point floc and deflocculated sludges on the basis of the sludge volume index, and the supernatant suspended solids for each sample. Statistical methods were used to test the equality of group means with respect to 86 variables representing conditions in the sludge environment, including the influent and effluent as well as the mixed liquor. Each of the 86 variables was then plotted against both sludge volume index (SVI) and supernatant suspended solids (SNSS). Primary factors affecting organisms which affect settling characteristics are alkalinity, soluble COD, COD loading, volatile content, particle size, DO concentrations, pH, and

temperature. Predominance of filamentous fungi resulted in good settling characteristics, while predominance of filamentous bacteria resulted in bulking. SVI—35.6..159.7 (bacterial filament count) was established, with 80% of the variance in SVI being explained by the presence of bacterial filaments. (Lowry-Texas)
W71-13409

GREASE REMOVAL BY A COMPLETELY MIXED ACTIVATED SLUDGE PLANT AND METHODS FOR ENHANCING GREASE REMOVAL,
Virginia Polytechnic Inst and State Univ; Blacksburg.
Larry K. Owens.
Master's Thesis, November, 1970, 45 p, 11 fig, 1 tab, 16 ref.

Descriptors: *Activated sludge, *Microorganisms, *Metabolism, Emulsions, Colloids, Oil, Lipids, Laboratory tests, Acclimatization, Surfactants, Color, Sludge worms, Rotifers, *Waste water treatment.
Identifiers: Blending, *Grease, Fatty acids, Wax, Sludge volume index, Stalked ciliates.

A laboratory scale complete mix activated sludge plant was fed various concentrations of blended and unblended grease emulsions, blended and unblended wastewater, and variations of the above treated with surfactant. Effluent grease concentration versus time graphs clearly indicated that grease was readily metabolized by the activated sludge organisms. Amounts metabolized varied dependent upon influent grease concentrations feed blending, and surfactant concentration. Overall removal efficinecies of 76 and 68% were recorded with blended influent grease concentrations of 100 and 200 mg/l respectively. Each concentration required a 3 day acclimation period, indicating decreased efficiencies for installations receiving wastes which vary widely in grease content. The addition of ABS decreased removal efficiency, probably a result of an inhibitory environment caused by the increased surfactant concentration. Testing with blended sewage as substrate yielded much higher grease removal efficiencies, indicating that efficiencies in excess of 90% are attainable in activated sludge plants modified to provide blending prior to biological treatment. (Lowry-Texas)
W71-13410

WASTEWATER TREATMENT BY ELECTROLYSIS IN CALCIUM FLUORIDE,
Nihon Univ., Tokyo.
Masakuni Kanai.
Proceedings, Industrial Waste Conference, 24th, May 6-8, 1969, p 1-5, 4 fig, 2 tab.

Descriptors: *Waste water treatment, *Industrial wastes, *Electrolysis, Fluorides, Electric current, Electrodes, Copper, Aluminum, Flotation, Pressure, Iron, Oil, Chemical oxygen demand, Water reuse, Biological treatment.
Identifiers: Voltage, *Japan.

Land in the Tokyo area is too expensive to economically accomodate the large areas needed for conventional biological wastewater treatment. In many areas, such as the factory area of the Japan National Railway, there is simply no land available regardless of cost. Investigations were conducted by a research committee of the railway to find an alternative treatment method for the factory wastewater. The waste-water contains oil, iron, cleanser, and carbon black. A pilot scale study (2600 gal/hr) was performed on the fluoride electrolysis method. Electrodes of copper and aluminum were spaced to 8 to 10 cm apart, the applied voltage was 8 to 10 v D.C., and the electrical power used was 100 whr/m3 or less. This configuration resulted in a current of about 3 amp/m3 and a treatment time varying from 20 to 40 min. The electrolytically produced floc was removed in a dissolved air flotation system operating at an 8.5lb/in2 pressure. Total chemicals added throughout the system were 30 mg/l MgC12, 5 mg/l cleanser, and 20 mg/l CaF2. Water suitable for re-use in the plant without chlorination was produced for approximately $.01/1000 gal. (Lowry-Texas)
W71-13411

THE DESIGN AND OPERATION OF A PRIVATE WASTE DISPOSAL PLANT NEAR SARNIA, ONTARIO,
Trecan Ltd., Cooksville (Ontario).
W. K. Lombard.
Proceedings, Industrial Waste Conference, 24th, May 6-8, 1969, p 6-12, 6 fig.

Descriptors: *Industrial wastes, *Incineration, Land-fill, Sedimentation, Injection wells, Temperature, Oily wastes, Phenols, Cost analysis, *Waste disposal, Waste water treatment.
Identifiers: *Centralization, Caustic, Canada.

A full scale plant constructed solely for the purpose of collecting, stabilizing, and disposing of industrial wastes from several locations has been operative for several months. An anticipated 50,000 cu. yds. mixed wastes and 10,000 cu. yds. of liquids to be incinerated are needed annually to allow the plant to operate at maximum efficiency. The five disposal systems include: (1) incinerating burners for combustible liquids;' (2) bulk waste incinerators for high BTU and low BTU bulk materials; (3) a deep well for clean aqueous liquids; (4) lagoons for temporary hold-up and settling of liquids; (5) property for burial and land-filling of bulk and semi-liquid materials which cannot otherwise be disposed of. Hopefully, this plant will serve as a prototype of the type of plant which can be produced if industry, government, and the public cooperate. (Lowry-Texas)
W71-13412

THE EFFECTS OF RECIRCULATION ON THE PERFORMANCE OF TRICKLING FILTER MODELS,
Rice Univ., Houston, Tex.
G. J. Kehrberger, and A. W. Busch.
Proceedings, Industrial Waste Conference, 24th, May 6-9, p 37-52, 13 fig, 22 ref.

Descriptors: *Trickling filters, *Biodegradation, Flow rates, Waste dilution, Microorganisms, Organic loading, Solubility, Diffusivity, Dissolved oxygen, Aerobic conditions, Anaerobic conditions, Nutrients, Nitrates, *Waste water treatment, Filtration, Model studies.
Identifiers: *Fixed film biological reactors, *Recirculation.

A theroetical analysis of the effect of recirculation of trickling filter effluent on removal of total organic carbon was conducted. The general heterogeneous, reaction control, and pseudo homogeneous models were considered. Development and solution of the mathematical models are not discussed. For heterogeneous film flow reactors, recirculation was found to have a definite detrimental effect on total soluble organic carbon removal. For pseudo homogeneous film flow reactors, the exact opposite effect was observed. The possible accumulation of organic intermediates in the heterogeneous reactors was also indicated. Removal of organics passed thru as intermediates can be accomplished, but it requires use of a separate stirred reactor with a mixed biological population. Therefore, recirculation was shown to be completely unamenable to universal declarations of beneficial or detrimental without prior knowledge of the operating system and conditions. (Lowry-Texas)
W71-13414

THE EFFECT OF WASTE ACTIVATED SLUDGE ADDITION IN VACUUM FILTRATION OF PRIMARY CLARIFIER SLUDGES,
Western Michigan Univ., Kalamazoo. Dept. of Paper Technology.
Andre L. Caron, and Ciro A. Mazzola.
Proceedings, Industrial Waste Conference, 24th, May 6-8, 1969. p. 850-866. 12 fig, 1 tab, 5 ref.

Descriptors: *Vacuum drying, *Dewatering, *Sludge, Separation techniques, *Filtration, Industrial wastes, Pulp and paper industry, Activated sludge, Lime, Coal, *Waste water treatment.
Identifiers: *Vacuum filtration, Chemical conditioning, Primary sludge, Loading rate, Filtrate.

Addition of waste biological sludge to high combustible-low ash content boxboard and low combustible-high ash content deinking clarifier sludges adversely affected loading rate, drainage rate, cake solids, and solids retention on vacuum filtration. Long chain organic polymer conditioning produced 100.. % improvement in loading and drainage rates, producing low suspended matter filtrates and increased cake solids contents at $3 to $6 per ton of dry solids. A 10% Ca (OH2) dosage resulted in 4 and 5-fold loading rate increases for deinking sludge and a 1.5 fold increase for boxboard sludges, when compared to similar non-conditioned primary-secondary sludge mixtures. Solids recovery efficiency increased from 90 to 95 and 99% respectively, and both cake solids content and drainage rate were also improved. For deinking sludge, lime conditioning with 10% lime addition at $2.50/ton of dry solids could save as much as $21,000 per ton of sludge processing capacity per shift in initial dewatering facility cost. Addition of pulverized coal to various primary-secondary sludge mixtures was also tried, and filtration parameters were improved slightly. In the case of conditioning before incineration, pulverized coal addition would add a heat source of valuable dimensions. (Lowry-Texas)
W71-13417

HIGH SOLIDS, BIOLOGICAL AERATION OF UNNEUTRALIZED UNSETTLED TANNERY WASTES,
Syracuse Univ., N.Y. Dept. of Civil Engineering.
Dwight B. Emerson, and Nelson L. Nemerow.
Proceedings, Industrial Waste Conference, 24th, May 6-8, 1969. p. 867-879, 9 fig, 6 tab, 4 ref.

Descriptors: *Industrial wastes, *Neutralization, *Sedimentation, Pilot plants, Organic loading, *Biochemical oxygen demand, Hydrogen ion concentration, Chromium, Suspended solids, Sludge, Activated sludge, Aeration, *Waste water treatment.
Identifiers: *Tannery wastes.

Approximately 16 billion gallons of wastes were produced by the leather tanning industry in 1963. Constituents in the wastes produced differ according to the tanning process used. Mineral tanning wastes contain salt, chromic oxide, sulfuric acid, Ca (OH)2, sodium sulfide, and sodium hydrosulfite. Previous treatment methods used applied neutralization and primary settling as preliminary steps before biological treatment. In this investigation, a bench scale pilot plant was constructed and acclimated to unneutralized, unsettled chrome tanning wastes. BOD, pH, suspended solids, sludge characteristics, and chromium concentration tests were performed regularly. No attempts to adjust sludge recycle to full scale rates were made. Solids were allowed to build up in the clarifier until inefficient settling took place, at which time solids were wasted. BOD reductions ranging from 75 to 98% were obtained. A 1/20 scale pilot plant was also constructed from this data, and subjected to an organic loading of 140 lb BOD/1000 ft3 at a hydraulic load of 8.75 gal/min. With this unit, an average 90% BOD reduction, and a drop in pH from 11 to 7.5 were obtained, indicating the feasibility of omitting both presedimentation and neutralization. (Lowry-Texas)
W71-13418

COMBINED TREATMENT OF CHEMICAL WASTES AND DOMESTIC SEWAGE IN GERMANY,
Bayernwerk A. G., Wuppertal (West Germany).
Wupperverband.

W. Bischofsberger.
Proceedings, Industrial Waste Conference, 24th, May 6-8, 1969, p 920-938, 13 fig, 6 tab.

Descriptors: Industrial wastes, Municipal wastes, *Biological treatment, Organic loading, Nutrients, Toxicity, Hydrogen ion concentration, Biochemical oxygen demand, Oxygenation, Activated sludge, Mixing, Biodegradation, Design criteria, *Waste water treatment, *Chemical wastes, *Domestic wastes.
Identifiers: West Germany, *Combined treatment.

Analysis of domestic wastes revealed in presence of nitrogen and phosphorous in excess of the amount required for cell synthesis to degrade the domestic wastes alone. Mixing domestic wastes with nitrogen or phosphorous deficient wastes would both reduce nutrients in the effluent, and allow biological treatment of the industrial wastes without chemical additions. Pilot plant testing programs were conducted on industrial wastes from the Faberfabriken Bayer installations at Wuppertal and Leverkusen and on mixed domestic and industrial wastes at the municipal wastewater treatment plant. Two stage biological treatment of a 1:1 mixture of industrial wastes to either cooling water supplemented with nutrients or domestic wastes produced an effluent of less than 50 mg/1 BOD. Volumetric loading on the first stage was 2.5 kg/m3/day and 0.5 kg/m3/day in the second stage. 90 to 95% BOD removals required a sludge loading of 0.5 kg BOD and 0.1 k BOD/kg dry solids in the first and second stages respectively and 2 kgO2 per kg total BOD applied. A schematic of the treatment system designed from these studies is presented. (Lowry-Texas)
W71-13419

WASTES FROM BRITISH PAPER MILLS,
Wiggins Teape Research and Development Ltd., Beaconsfield (England).
W. T. Roberts.
Proceedings, Industrial Waste Conference, 24th, May 6, 7, and 8, 1969, p 950-956, 3 tab, 4 ref.

Descriptors: *Waste water treatment, *Pulp wastes, *Water reuse, Water quality control, Flocculation, Sedimentation, Sludge disposal, Activated sludge, *Effluents, *Reclaimed water, Water demand, Industrial wastes.

The current water demand in England is near 10,550 billion US gallons per year and this damand is expected to double by the year 2,000. England is divided into River Authorities whose main concern is water conservation and river pollution. The paper industry shares these concerns and our efforts to stem the pollutional effects of our effluents has taken two courses, conventional treatment and increased water reuse. Conventional treatment provides adequate effluent quality but we have noticed that sewage fungus thrives in some rivers downstream from our outfalls. We are not sure what causes this or how to eliminate the problem. Since our plants must now pay for water and water must be husbanded like any other resource, we have instituted a system of recirculating the water within the plant. So far, the results have been dramatic. The BOD had increased but the loading on the treatment plant has decreased. The bacteria count it up as was expected. Savings on the order of $288,000 a year have been obtained. Water reuse has also alleviated the sewage fungus problem mentioned earlier. New machines designed to accept reused water shown great promise in increasing the benefits from this concept. Effluent purification is expensive and gives no return on capital. In-plant recovery of water results in substantial savings and provides for a better effluent. (Goessling-Texas)
W71-13420

REDUCTION OF MERCURY IN WASTE WATERS FROM CHLORINE PLANTS,
Swedish Water and Air Pollution Research Lab., Stockholm.
H. O. Bouveng, and P. Ullman.
Proceedings, Industrial Waste Conference, 24th, May 6,7, and 8, 1969, p 969-978, 3 fig, 3 tab, 4 ref.

Descriptors: *Water quality control, Water pollution sources, Food chains, Sewage effluents, *Waste water treatment, Metals, Heavy metals, Industrial wastes.
Identifiers: *Mercury discharges, *Chlorine plants, Caustic soda process.

The Swedish nature conservancy authorities require that mercury discharges be prevented to the extent technically and economically possible. One consequence of this is the requirement for the chlorine industry to drastically reduce its mercury discharges. A joint study by the institute and the industry was conducted to determine what should be done. The literature indicated rather high losses of mercury were to be expected as normal and the industry had accepted these as a part of doing business. Each step in the process was examined for the possibility of mercury loss and measures that would preclude or reduce this loss were established. First step is to separate the sewage system so that normal waste waters would not contain mercury and the remaining waste waters which do contain mercury would be in small quantities that could be economically treated. The condensate from the chlorine conduits which contains small amounts of mercury is recycled to the brine. Hydrogen is cooled to 5 degrees C. before emmission which reduces the mercury content markedly. Caustic soda is filtered through carbon and the mercury in the filtrate is recovered by distillation. Cell room losses due to maintenance and spillage are recovered by better designed room arrangements and sedimentation traps. Additional measures can be taken if warranted. The measures discussed above indicate a savings which may pay for themselves. (Goessling-Texas)
W71-13421

ELECTRODE POTENTIALS AND ELECTROLYTIC CONTROL IN THE ANAEROBIC DIGESTION PROCESS,
Northeastern Univ., Boston, Mass.
F. C. Blanc, and A. H. Molof.
Proceedings, Industrial Waste Conference, 24th, May 6, 7, and 8, 1969, p 1040-1059, 12 fig, 1 tab, 11 ref.

Descriptors: *Waste water treatment, *Anaerobic digestion, Sludge digestion, Methane bacteria, Acid bacteria, *Electrolysis, Hydorgen ion concentration, *Electrodes, Automatic control.
Identifiers: pH Control, *Electrolytic control.

With improved treatment methods and greater organic removals in the sewage treatment process, the problems of sludge stabilization and disposal have greatly increased. Anaerobic digestion is an extensively used method of sludge stabilization. Maximum efficiency is not being realized due to a lack of understanding of the process mechanism and control. The electrode potential measurement is a monitoring parameter that can be used effectively in the anaerobic digestion process. The potential was measured in laboratory experiments between a platinum indicating electrode and a calomel reference electrode. The potential measured was the sum of all the oxidation-reduction reactions taking place in the digester. Such potentials are apparently the result of the activity of the methane forming bacteria. These experiments indicated that optimum digestion took place at -510 mv Ec with an operating range of -450 to -550 mv Ec. Direct current electrolysis was demonstrated as a means of controlling the pH of the digester. This method was used to correct a depression in pH until the digester could recover and allowed the operation to continue at high concentrations of volatile acids and shorter detention times. The monitoring equipment can be installed for a modest capital cost. Electrolytic control of the pH appears to be feasible and should be tested further in pilot scale units. (Goessling-Texas)
W71-13422

INFLUENCE OF MICROBIAL WASTE PRODUCTS ON METABOLIC ACTIVITY OF HIGH SOLIDS ACTIVATED SLUDGE,
Rennselaer Polytechnic Inst., Troy, N.Y.
D. R. Washington, L. S. Clesceri, J. C. Young, and F. W. Hardt.
Proceedings, Industrial Waste Conference, 24th, May 5, 7, and 8, 1969, p 1103-1117, 14 fig, 2 tab, 9 ref.

Descriptors: *Activated sludge, *Waste water treatment, *Metabolism, Inhibition, Carbon, Nitrogen, Phosphates.
Identifiers: *High solids concentrations, Metabolic end products, Oxygen uptake rate, *Utrafiltration.

Studies on the kinetics of activated sludge processes have led to an inquiry concerning the applicability of the model to concentrated microbial systems. Problems of oxygen transfer and solids separation have been investigated. Ultrafiltraton has proven suitable as a solids separation device for a high solids activated sludge system. Ultrafiltration can remove nearly all of the dissolved solids but some of the unused waste and the metabolic end products are left in the effluent. The metabolic end products could have an effect on the biological activity of the system. To determine this, relative changes in carbon, phosphate, nitrogen, glucose and oxygen uptake were measured in a system using ultrafiltration and recirculation. A laboratory scale reactor was operated for 50 days with a suspended solids concentration of 12 g/l and volatile solids about 10 g/l. Warburg studies and Gel Chromatography were used to measure the parameters mentioned above. The results of these experiments indicate that the oxygen uptake rate decreases as the concentration of metabolic end products increases. Some planned wasting of the mixed liquir is required to maintain the culture at a high metabolic activity. The metabolic end products that interfere with the anaerobic activity of the culture are apparently in the molecular range above 700. (Goessling-Texas)
W71-13424

BORON ADSORPTION ON SOILS AND BIOLOGICAL SLUDGES AND ITS EFFECTS ON ENDOGENOUS RESPIRATION,
Delaware Univ., Newark.
S. K. Banerji.
Proceedings, Industrial Waste Conference, 24th, May 6, 7, and 8, 1969, p 1118-1127, 8 fig, 1 tab, 14 ref.

Descriptors: *Waste water treatment, *Boron, *Adsoprtion, Inhibition, Biological treatment, Detergents, Soils, Sludge, Water pollution effects.
Identifiers: *Endogenous respiration, Kaolinite, Illite.

Increased use of boron salts in household detergents and in other industrial uses has posed questions concerning the effect of these substances on the environment. It has been shown that boron concentrations of 19 mg/l in waste waters have produced a significant toxicity to the activated sludge process. Current levels of boron in waste water is much lower than this and no ill effects should be expected unless there is a significant amount of boron adsorbed on to the sludge and other solids in the process. The adsorption of boron on illite and kaolinite clays and on biological solids has been studied in the laboratory. The effect of boron on endogenous respiration has been studied and results are reported here. Kaolinite adsorbes about 40 times more boron than illite when exposed to boron in solutions of 1 mg/l. Activated sludge adsorbes about 1/8 of the amount adsorbed by kaolinite under the same conditions. Freundlich adsorption coefficients are determined for each substance and with kaolinite for different values of pH. Indications are that normal sewage treatment processes which utilize recirculation and sludge thickening may result in boron concentrations three times the influent concentrations. This might inhibit biological activity in the aeration tanks, inhibit sludge digestion or degrade the utility of dried sludge as a soil conditioner. Boron significantly reduces endogenous respiration and the effect of this on aerobic systems should be studied further. (Goessling-Texas)
W71-13425

THE ANAEROBIC FILTER FOR THE DENITRIFICATION OF AGRICULTURAL SUB-SURFACE DRAINAGE,
Federal Water Pollution Control Administration, Fresno, Calif.
T. A. Tamblyn, and B. R. Sword.
Proceedings, Industrial Waste Conference, 24th, May 6, 7, and 8, 1969, p 1135-1150, 6 fig, 6 tab, 19 ref.

Descriptors: *Waste water treatment, *Denitrification, *Filters, Anaerobic bacteria, Sands, Carbon, Coals, Aggregates, Waste disposal, California, Anaerobic conditions, Filtration.
Identifiers: Volcanic cinders, San Joaquin River (Calif).

The vast majority of saline agricultural wastewater being generated in the San Joaquin Valley is discharged to the San Joaquin River. To avoid this, a project is underway to transport these wastewaters to a 'safe' disposal area. One of the problems associated with this water in nitrogen removal. The characteristics of this water as it is now and is projected to be in 2020 is shown. Nitrogen in the wastewater is primarily in the nitrate form. A series of anaerobic filter studies to determine the nitrogen removal efficiencies have been conducted. Filters of diameters 4 inch, 18 inch and 36 inch were tested and media varied from sands to 1 inch smooth aggregate. Laboratory and field studies were conducted to verify operational factors. Results indicate that San Joaquin Valley subsurface water can be denitified efficiently using anaerobic filters, the sorptive characteristics of the media used had no apparent effect on nitrogen removal efficiency, use of media less than 1 inch diameter resulted in high headlosses and/or low nitrogen removal, depending on the temperature efficient nitrogen removal can be obtained at hydraulic detention times of 0.5 hours to 2 hours and long term operation without backwashing is feasible. (Goessling-Texas)
W71-13426

INFLUENCE OF NITROGEN SUPPLY ON BIOLOGICAL TREATMENT,
Badische Anilin and Soda-Fabrik AG., Ludwigshafen am Rhein (West Germany).
W. Haltrich.
Proceedings, Industrial Waste Conference, 24th, May 6, 7, and 8, 1969, p 1185-1194, 9 fig, 1 tab, 17 ref.

Descriptors: *Waste water treatment, *Activated sludge, *Nitrogen, Carbon, Treatment facilities, Organic wastes, *Biological treatment, Nitrification.
Identifiers: Federal Republic of Germany.

This plant has greatly increased its production over the past few years. The products are primarily plastics and other organic materials. There has been considerable trouble in treating the waste waters to the degree necessary for safe discharge into the receiving waters. An analysis of the wastewater determined that the primary constituents were pure carbon compounds and that insufficient nitrogen was available for efficient stabilization of the waste in the activated sludge treatment works on the site. The waste had a BOD of 250-300 mg/l, a total organic carbon of 160-190 mg/l and a nitrogen content of 2-3 mg/l. Three experimental activated sludge units were operated in parallel with various quantities of nitrogen in the form of urea added to determine the proper amount necessary for effective waste treatment. The addition of 5 mg/100 mg BOD5 was required to achieve full biological treatment. Lesser quantities resulted in sharply decreased efficiency and much greater sensitivity of the process to increased loads. It was found that the biologically active solids were nearly proportional to the fraction of nitrogen in the system and when this fraction decreased below 5%, the bacteria available to stabilize the waste were not adequate to the task. (Goessling-Texas)
W71-13427

TREATMENT OF PARAMAGNETIC SLURRIES FROM STEEL MILL OPERATIONS BY DOUBLE FLOCCING,
Davco Corp., Pittsburgh, Pa.
D. F. Peck, and T. J. McBride.
Proceedings, Industrial Waste Conference, 24th, May 6, 7, and 8, 1969, p 1201-1211, 12 fig.

Descriptors: *Waste water treatment, *Separation techniques, Industrial wastes, *Tertiary treatment, Sludge treatment, Slurries, Steel.
Identifiers: Paramagnetic slurries, Anionic polymer, Magnetic field, *Double floccing, Polymers, *Paramagnetic slurries.

The adoption of stronger pollution control measures has stimulated the industrial community to intensify research activities in the development of new and improved techn· logy for waste water treatment. Paramagnetic waste waters have traditionally proved difficult to treat from the standpoint of color and solids removal. Laboratory investigations have resulted in the development of a new process which dramatically improves solid separation in these wastes. The process consists of first treating the slurry with an anionic polymer and then controlled exposure to a magnetic field prior to setting in conventional equipment. Settling rates are higher than for any other form of treatment of these wastes. Although treatment is good, a tertiary deep-bed filter treatment is recommended where high quality effluents are required. There is considerable savings in tank size and real estate required for waste water treatment. The use of the magnetic field reduces the requirement for polymers. This process will reduce overloading in existing facilities. The permanent magnet acts as a back up should the polymer feed system fail. Improved sludge handling characteristics result from this process. The polymer-magnetic double floccing system is an advanced means for treating paramagnetic slurries from steel mill operations. (Goessling-Texas)
W71-13428

CANNERY WASTE TREATMENT BY THE KEHR ACTIVATED SLUDGE PROCESS,
FMC Corp., Santa Clara, Calif. Central Engineering Labs.
R. A. Fisher, and H. S. Smith.
Proceedings, Industrial Waste Conference, 24th, May 6, 7, and 8, 1969, p 1212-1237, 15 fig, 4 tab, 3 ref.

Descriptors: *Waste water treatment, *Activated sludge, Canneries, Industrial wastes, *Sludge digestion, Digestion, Sludge treatment, *Aerobic conditions, Oxidation lagoons, California.
Identifiers: *Sludge wasting, Suspended solids, Shock loads, *Aerated tanks, Santa Clara (Calif).

Conventional activated sludge systems are used extensively for the treatment of industrial waste waters. This is susceptible under certain conditions to problems caused by shockloads due to either high strength sewage of increased flows. Professor Dietrich Kehr of Hanover, Germany has adapted the activated sludge process to treat shock loads such as those from cannery plants or packing plants. The adaptation consists of returning all sludge from the secondary clarifier to the aeration tank, operating the system with a high mixed liquor suspended solids of 10,000 to 14,000 mg/l and digesting the sludge aerobically in the aeration tank. The FMC Corporation tested this adaptation in it's laboratories using 120 gal. aeration tank and sewage taken from the Santa Clara collection system. Mixed liquor suspended solids were maintained in the range of 5,000 to 10,000 mg/l, aeration times were varied from 2 to 8 hours and shock loading was simulated by conditioning the tank for 48 hours with fresh water influent prior to treating domestic sewage with a strength of about 300 mg/l BOD. BOD and TOC removal averaged nearly 90% for shock loads. TOC, phosphorus and nitrogen removal was not as good as in conventional activated sludge. This adaptation simplified the system by eliminating sludge handling facilities. The effluent has high turbidity and color due to solids carry-over. The system can stand long periods of no loading. (Goessling-Texas)
W71-13429

THE SIGNIFICANCE OF BATCH TREATMENT KINETICS IN ACTIVATED SLUDGE DESIGN,
Weston (Roy F.) Inc., West Chester, Pa.
C. A. Vath, W. D. Sitman, and R. F. Weston.
Proceedings, Industrial Waste Conference, 24th, May 6, 7, and 8, 1969, p 1238-1248, 10 fig, 4 ref.

Descriptors: *Waste water treatment, Design, *Activated sludge, Kinetics, *Biochemical oxygen demand, *Biological treatment, Sewage treatment.
Identifiers: *Contact stabilization, *Batch treatment studies.

The use of batch biological treatability procedure for evaluating the BOD removal kinetics of a wastewater can significantly reduce costs and time in determining the design parameters for activated sludge and contact stabilization systems. The procedure requires the loading of four barch reactors with MLVSS in relative concentrations of 1, 2, 4, and 8. Equal volumes of the design sewage are added to each reactor. The reactors are aerated until BOD removal and stabilization has been completed as determined by periodic sampling. The BOD removal rate and the oxygen uptake rate can be measured. These data can be used to determine the necessary design parameters for conventional activated sludge. Should the BOD stabilization lag the BOD removal, the contact stabilization process is indicated. Examples of the application of this procedure to two diverse types of wastewaters are shown. The determination of BOD removal kinetics by the batch method saves time and money. The coefficients thus determined can be transformed to their counterparts for conventional and contact stabilization activated sludge processes. Continuous flow treatability studies using the parameters determined in this fashion have verified the validity of the procedure for these wastes. (Goessling-Texas)
W71-13430

BIOLOGICAL DENITRIFICATION OF WASTEWATERS BY ADDITION OF ORGANIC MATERIALS,
Stanford Univ., Calif.
P. L. McCarty, L. Beck, and P. S. Amant.
Proceedings, Industrial Waste Conference, 24th, May 6, 7, and 8, 1969, p 1271-1285, 2 fig, 7 tab, 17 ref.

Descriptors: Water quality control, *Denitrification, Bacteria, Organic compounds, Organic wastes, *Biological treatment, *Waste water treatment, Nitrates, Nitrogen compounds, Methanol.
Identifiers: Pseudomonas, Achromobacter, Bacillus, Electron donor, *Nitrate nitrogen.

Biological denitrification has been suggested as a method for removing nitrate nitrogen from wastewaters when this is required for control of eutrophication. The process requires the availability of an electron donor and such availability is not always predictable. This study was initiated by the California Department of Water Resources to evaluate the effectiveness, required concentration and cost of several possible organic materials capable of facilitating denitrification. Sugar, acetate, acetone ethanol and methanol were tested for their ability to support denitrification. Methanol was selected as the most desirable of the five since it costs less on an equivalent basis, is a highly pure liquid and can be added easily and accurately to the wastewater. It was found that methanol must be added in quantities 1.3 times the stoichmetric quantity to permit deoxygenation. This is similar in all chemicals tested except for sugar which had a higher value. The concentration of methanol is computed to be 2.37 times the nitrate concentration, 1.53 times the nitrate concentration and 0,87 times the dissolved oxygen concentration. Anaerobic filters were selected as the most desirable form of mechanizing this process. (Goessling-Texas)

W71-13431

SEWAGE TREATMENT FACILITIES, STATE GRANTS.
For primary bibliographic entry see Field 06E.
W71-13507

USE OF IMPROVED MEMBRANES IN TERTIARY TREATMENT BY REVERSE OSMOSIS,
McDonnell Douglas Corp., Newport Beach, Calif. Astropower Lab.
H. K.Bishop.
Environmental Protection Agency, Water pollution Control Research Series, December 1970. 65 p, 14 fig, 19 tab, 7 ref.

Descriptors: *Reverse osmosis, *Membranes, Separation techniques, *Tertiary treatment, Nutrients, Cations, Anions, Temperature, Pressure, Hydrogen ion concentration, Conductivity, Sampling, Chemical oxygen demand, Economic feasibility, Technical feasibility, *Waste water treatment, Membrane process, Osmosis.
Identifiers: *Cellulose acetate, Flux.

A reverse osmosis study with a threefold objective was conducted. In phase I, tubular membranes prepared from trans esterified cellulose acetate were compared with membranes made from commercially available cellulose acetate (Control). Phase II involved evaluation of the in-situ regenerable membrane reverse osmosis design on waste water. Phase III consisted of subjecting the membranes to carbon treated secondary effluents, primary effluents, and concentrated primary effluents. Results showed that the modified tubular membranes produced fluxes slightly greater than the control membranes while in-situ regenerable membranes produced fluxes significantly below those obtained with tubular units. On carbon treated secondary effluents, modified tubular membranes produced an overall average product water flux of 15 gfd, compared to 10 gfd for the control. Initial levels were 15 and 25 gfd for the control and the modified membranes respectively, and these fluxes could be maintained by cleaning every 10 days with an enzyme presoak (Biz). Flux for the concentrated primary effluent (9 times the solids in primary effluent) stabilized at 4 to 5 gfd. Removal of wastewater constituents remained nearly constant at 90 to 100% for all three feeds, thus establishing the technical feasibility A program to establish economic feasibility was also presented at a cost estimated at $250,000. (Lowry-Texas)
W71-13513

A STATE-OF-THE-ART REVIEW OF METAL FINISHING WASTE TREATMENT.
Batelle Memorial Inst., Columbus, Ohio. Columbus Labs.

Copy available from GPO Sup Doc for $1.00; microfiche from NTIS as PB-203 207, $0.95. EP 2.10:12010 EIE-11-68. Environmental Protection Agency, Water Pollution Control Research Series, November 1968. 53 p, 8 fig, 7 tab, 135 ref. EPA Program 12010 EIE 11/68. WPRD 201-01-68.

Descriptors: *Industrial wastes, *Toxicity, *Metals, Water quality control, Hydrogen ion concentration, *Waste water treatment, Technical feasibility, Cost analysis, *Reviews, Water pollution sources.
Identifiers: *State-of-the-Art Review, *Plating wastes, By-product recovery.

Water borne wastes generated in the electroplating and metal finishing industry include: (1) rinse waters from plating, cleaning, and other surface finishing operations; (2) concentrated plating and finishing baths that are accidentally or intentionally discharged; (3) wastes from plant or equipment clean up; (4) sludges, filter cakes, etc.,; (5) regenerants from ion exchange units; and (6) vent scrubber waters. Control measures discussed include in-plant control measures for waste reduction, as well as chemical, physical, and biological detoxification techniques for the various waters to be treated. The methods presented were developed for use by the large scale manufacturing operations and are now presented for the benefit of the small operator. Evaluation and cost estimation of these techniques as applied to smaller operations will be a major objective of investigations in subsequent phases of the program. (Lowry-Texas)
W71-13514

STUDIES ON DENSIFICATION OF COAL MINE DRAINAGE SLUDGE,
Bituminous Coal Research, Inc., Monroeville, Pa.
R. C. Streeter, R. K. Young, and R. A. Glenn.
Copy available from GPO Sup Doc for $1.25; microfiche from NTIS as PB-203 189, $0.95. SN-5501-0101. Environmental Protection Agency, Water Pollution Control Research Series, September 1971. 113 p, 17 fig, 33 tab, 29 ref. EPA Program 14010 EJT 09/71.

Descriptors: *Sludge disposal, *Dewatering, *Coal mine wastes, Sludge, Neutralization, Lime, Acid mine water, Freeze drying, Chemical precipitation, Filtration, Carbon dioxide, Coagulation, Sedimentation, Water quality control, *Waste water treatment.
Identifiers: *Magnetic precipitation.

Bench scale batch experiments were performed on sludges obtained from lime neutralization of coal mine drainage in an attempt to alleviate present problems in sludge handling and disposal. Tests were of an exploratory nature and did not afford sufficient data for cost analyses. Ferro Magnetic sludge densification, filter aids, coagulant aids, heating, freeze drying, and coprecipitation of calcium carbonate through addition of CO2 were tested. Of these, freeze drying, CO2 addition, and ferro magnetic treatment were shown to be feasible alternatives to present disposal methods. Each of these methods resulted in settled sludge volume reductions of approximately 90% and increases in sludge solids contents of from 0.5 to about 5% after 30 min. settling periods. The ferro magnetic process has the advantages of possible recovery of a useful product, and elimination of costly settling lagoons, but is very sensitive to aluminum and requires a considerable amount of heat. Sludge freezing is the simplest conceptual approach and is apparently effective for any lime produced sludge. The CO2 addition method offers the possibility of partial recovery and recycling of both CaO and CO2 through sludge calcination. (Lowry-Texas)
W71-13515

ROTARY PRECOAT FILTRATION OF SLUDGE FROM ACID MINE DRAINAGE NEUTRALIZATION,
Johns-Manville Products Corp., Manville, N.J.
T. S. Brown.
Copy available from GPO Sup Doc for $1.25; microfiche from NTIS as PB-203 190, $0.95. SN-5501-0096. Environmental Protection Agency, Water Pollution Control Research Series, May 1971. 121 p, 32 fig, 28 tab, 8 ref. EPA Program 14010 DII 05/71.

Descriptors: *Vacuum drying, *Filtration, Sludge, Lime, Limestone, Dolomite, Alkalinity, Acid mine drainage, Neutralization, Sludge, Dewatering, Cost analysis, *Waste water treatment.
Identifiers: *Filter aids, *Sludge recirculation.

A two year study was conducted at 4 locations in Pennsylvania to test the effect of various alkalies and filter aids on rotary vacuum precoat filtration for dewatering of lime neutralization sludge. The process consisted of neutralization, aeration, sedimentation and filtration. Alkalies investigated were limestone, limestone with hydrated lime, calcined magnesite, partially and fully calcined dolomite, and hydrated lime. Filter aids tested included Hyflo, Super-Cel, and Celite 501, 503, and 545. Results from the first three locations indicated limestone and hydrated lime were preferred alkalies and Celite 501 the preferred filter aid. At the 4th site a 27 run factorial experiment investigating the effect of flow rate, limestone feed level, aeration level, and sludge recirculation level on equipment operation and process cost was conducted. Sludge solids content, filtration rate, and sludge recirculation were found to be significant variables affecting process cost. Estimated operating costs for a 1.5 MGD treatment plant using lime neutralization were $1.16/1000 gallons treated or $8.02 per 100 lbs of acidity treated. (Lowry-Texas)
W71-13516

UTILIZATION OF PHOSPHATE SLIMES,
International Minerals and Chemical Corp., Skokie, Ill.
Srini Vasan.
Copy available from GPO Sup Doc for $1.25; microfiche from NTIS as PB-203 191, $0.95. SN 5501-0097. Environmental Protection Agency, Water Pollution Control Research Series, August 1971. 128 p, 26 fig, 24 tab, 9 ref.

Descriptors: *Clays, *Phosphates, *Lightweight aggregates, Slurries, *Slimes, Concrete mixes, Industrial wastes, Mine water, Dewatering, *Water reuse, Waste water treatment, Florida, Waste disposal.
Identifiers: *By-product recovery, Kilns.

Phosphate slimes have been produced by the Florida phosphate mining industry at the rate of millions of cubic yards per year and the volume is increasing. The water retentive characteristics of the clays which are mined with the rock are such that there is more volume of phosphate slime to dispose of than there was actual rock mined. Small scale tests of the slimes were made to assess the feasibility of their use as building materials. A process was developed and demonstrated to be capable of producing a pelletized, light-weight aggregate, and finally a light-weight concrete from the slimes. The four major processing steps: (1) pumping of clay slurries of 3 to 30% solids; (2) slime drying in a fluid bed dryer; (3) pelletizing the dried product and (4) kilning the product to a suitable aggregate, were investigated in batch and suitable equipment was selected. Aggretage production could use up to 6-8 million tons of clay solids annually, releasing up to 5 billion gallons of water to the environment. (Lowry-Texas)
W71-13517

DEVELOPMENT OF PHOSPHATE REMOVAL PROCESSES, DEVELOPMENT AND DEMONSTRATION OF PHOSPHATE REMOVAL FACILITIES AT DETROIT USING AN ACTIVATED SLUDGE PROCESS AND STEEL PICKLING LIQUOR.
Detroit Metropolitan Water Dept., Mich.

Copy available from GPO Sup Doc for $0.65; microfiche from NTIS as PB-203 192, $0.95. SN-5501-0114. Environmental Protection Agency, Water Pollution Control Research Series. 54 p, 15 fig, 3 tab. EPA Program 17010 FAH 07/70. WPRD 51-01-67.

Descriptors: *Waste water treatment, Feasibility studies, Trickling filters, *Activated sludge, *Phosphates, Sludge disposal, Centrifugation, Vacuum drying, Chemical precipitation, Technical feasibility, *Pilot plants, Dewatering, Design.

Over 50 experiments were performed on various waste water treatment processes at a 200 gpm facility over a 20 month period. Major processes tested included chemical pre-treatment, activated sludge, plastic media trickling filters, deep tank aeration, and activated sludge disposal. Trickling filters were determined to be unsuitable, and the decision was made to design the full scale plant as an activated sludge plant that could be arranged in both the conventional and step feed process variations. The plant design should include deep tank aeration, and phosphate removal by injection of steel pickling liquor. Sludge disposal units investigated included vacuum filtration, centrifugation and filter pressing, but further research was

deemed necessary before the selection of a single unit. 87% phenol reduction was achieved in the biological oxidation process, somewhat below the 97% removal required. This lower removal percentage indicated the necessity of further investigations. (Lowry-Texas)
W71-13518

DEVELOPMENT OF A FROTH PROCESS FOR THE TREATMENT OF SOUR WATER,
New Mexico Water Resources Inst., University Park.
Donald B. Wilson.
Available from the National Technical Information Service as PB-203 193, $3.00 in paper copy, $0.95 in microfiche. Completion report, (1970). 30 p, 4 fig, 8 tab, 21 ref. OWRR A-020-N.MEX (1).

Descriptors: *Hydrogen sulfude, *Foam fractionation, Separation techniques, Surfactants, *Frothing, Catalysts, Oxidation, Sulfur, Cost analysis, Oxygen, Industrial wastes, *Waste water treatment.
Identifiers: *Sour water.

The purification of sour (H2S) water and the recovery of sulfur was accomplished using a surfactant-catalyst one step treatment process. The surface active materials were capable of forming stable intermediates with the H2S, and the foam generated by the surfactant caused the intermediates to be concentrated at the air-liquid interfaces of the bubbles. Subsequent removal, collapse of the foam, and separation of the sulfur particles allowed the surfactant to be recycled. Of the three surfactant and surfactant catalyst systems tested, sodium lauryl sulfate plus an ion catalyst produced maximum sulfur recovery of 16% by weight. Although hydrogen sulfide content was reduced to less than 0.1 ppm, residual surfactant content was 40 to 80 ppm, making the operation economically unfeasible because of the cost of the surfactant lost. Under the optimum operational conditions, 16% by weight sulfur recovery and 40 ppm residual surfactant, the operating expense was determined to be 3.5 mil/bbl of 200 ppm H2S water treated. (Lowry-Texas)
W71-13519

NITROGEN TRANSFORMATION IN ACTIVATED SLUDGE TREATMENT,
Toronto Univ. (Ontari). Dept. of Civil Engineering.
Jerzy Ganczarczyk.
Journal of the Sanitary Engineering Division, Proceedings, of the American Society of Civil Engineers, Vol 97, No SA 3, June 1971, p 247-256. 1 fig, 4 tab, 15 ref.

Descriptors: *Activated sludge, *Nitrogen, *Pulp and paper industry, Nutrients, Storage, Respiration, Inhibition, Industrial wastes, Municipal wastes, Biodegradation, *Waste water treatment, *Pulp wastes.
Identifiers: Steady state.

A 61 day test of an activated sludge plant treating nutrient deficient Kraft pulp mill waste was conducted. During the initial phase and final phase of the test the influent contained sufficient added nitrogen, but nitrogen supply was insufficient for 25 days during the middle of the experiment. It was determined that activated sludge treatment of such a waste may be associated with complete inhibition of the nitrification process. Final effluent ammonia content was nearly constant during the test, probably due to uniform ammonia release from nitrogen reserves in the activated sludge cells at a rate proportional to the endogeneous respiration. Demonstration of the general possibility of microorganism storage and subsequent utilization of surplus mineral nutrients indicated that nutrient requirements can be determined only on the basis of long time, pseudo steady-state conditions. Also, addition of nitrogen to the nitrogen deficient system caused bulking, probably a specific biological response to the fluctuation of the biosynthesis and bioxidation equilibria of the system. (Lowry-Texas)
W71-13520

PROBLEMS ASSOCIATED WITH PLANNING BOD EXPERIMENTS,
Wisconsin Univ., Madison; and Gesellschaft fuer Klaranlagen und Wasserversorgung m.b.H., Mannheim (West Germany).
Paul M. Berthouex, and William G. Hunter.
Journal, Sanitary Engineering Division, Proceedings, of the American Society of Civil Engineers, Vol 97, No. SA 3, June 1971, p 333-344, 5 fig, 1 tab, 7 ref.

Descriptors: *Biochemical oxygen demand, *Kinetics, *Statistical methods, Least square methods, Sampling, Correlation analysis, Design data, Data processing, Water quality control, *Treatment facilities.
Identifiers: Experimental design, Confidence limits.

BOD data have long been regarded as a tool in decisions regarding wastewater treatment facility design. However, designs have often been inadequate due to the fluctuations in the data, possibly due to the fact that the observations were poorly placed. Generation of theoretical data points from the first order BOD equation, and actual examination and recording of experimental data close in value to the theoretical data allowed the two data sets to be correlated. By consulting the theoretical data to determine the critical points, the investigator may sample only those critical points, thus acheiving greater accuracy at lesser cost. (Lowry-Texas)
W71-13522

BIOKINETIC EVALUATION OF BOD CONCEPTS AND DATA,
Engineering Science, Inc., Oakland, Calif. Research and Development Lab.
William E. Gates, and Sambhunath Ghosh.
Journal, Sanitary Engineering Division, Proceedings, of the American Society of Civil Engineers, Vol 97, No. SA 3, June 1971, p 287-309, 3 fig, 71 ref.

Descriptors: *Kinetics, *Biochemical oxygen demand, *Water analysis, Laboratory tests, Chemical oxygen demand, Bacteria, Protozoa, Respiration, Synthesis, Design data, Metabolism, Water quality control.
Identifiers: *Autoxidation, *Reaction rate constant.

The process of Biochemical oxygen demand is presented as occuring in three distinct phases: (1) bacterial utilization of organic material to support bacterial synthesis and respiration; (2) the injestion of bacteria by protozoa to support ptotozoan growth and respiration; and (3) the process of auto destruction of bacterial and protozoan biomass. Analysis of the kinetics of each of these three reactions demonstrated the impracticality of accurately representing BOD progression with simple first-order kinetic models. Although the traditional BOD kinetics have been shown to be inaccurate, they are also recognized to be still useful in situations where relative consistence and/or efficiency is to be measured. For stream analysis, treatment system evaluation, and industrial wastewater evaluation, however, a new set of techniques for measuring the three subprocesses are presented along with methods for their application. (Lowry-Texas)
W71-13523

CHARACTERIZATION OF TIME-VARYING ORGANIC LOADS,
Idaho Univ., Moscow. Engineering Experiment Station.
Alfred T. Wallace, and Donald M. Zollman.
Journal, Sanitary Engineering Division, Proceedings, of the American Society of Civil Engineers, Vol 97, No. SA 3, June 1971, p 257-268, 6 fig, 6 tab, 6 ref.

Descriptors: *Organic loading, *Statistical methods, *Fluctuations, Mathematical models, Design criteria, Sampling, Chemical oxygen demand, Industrial wastes, Municipal wastes, *Waste water treatment, *Treatment facilities.
Identifiers: *Autocorrelation, Ergodic, Stationarity, Interpolation.

Long term loading fluctuations are considered in the design of wastewater treatment plants, but the effects of short term variations are ignored. Records obtained from the Minneapolis-St. Paul Sanitary district of original time-COD concentrations were analyzed statistically. It became evident that significant slowly varying periodic-like daily trends existing in the data were responsible for the fact that no meaningful characterization of the random hourly variations in the organic load was obtained. However, when the data were normalized by removing from the record a fourth-order polynomial regression line fitted to a 24 hour segment of the data, statistical analysis did yield what was believed to be a meaningful characterization of the hourly variations. In particular, these normalized data were found to be stationary, ergodic, and normally distributed. Auto correlation analysis of the data showed a low degree of correlation at lags greater than 1 year and thus a high degree of randomness. The next logical extension of this work is modelling of the system, both for municipal and industrial wastewater to provide more precise information for systems analysts. (Lowry-Texas)
W71-13524

BATCH ADSORPTION KINETICS IN SEWAGE-ACTIVATED CARBON,
Syracuse Univ., N.Y. Dept. of Chemical Engineering and Metallurgy.
Jeffrey S. Hsieh, Chi Tien, and Raffi M. Turian.
Journal, Sanitary Engineering Division, Proceedings, of the American Society of Civil Engineers, Vol 97, No. SA 4, August 1971, p 505-521, 9 fig, 5 tab, 13 ref.

Descriptors: *Activated carbon, *Adsorption, *Design data, Kinetics, Biodegradation, Filtration, Design criteria, Municipal wastes, *Waste water treatment.
Identifiers: *Freundlich Isotherm.

Solid-liquid adsorption systems, consisting of granular activated carbon and wastewater of three types: (1) screened raw influent; (2) post primary treatment effluent; and (3) secondary treatment effluent were monitored. The three wastewater types contained approximately 50, 50 and 20 ppm TOC respectively. Strong agitation within the system was used to eliminate the contribution of liquid phase resistance and establish the diffusion process within the carbon as the rate controlling step. The rate of decay of organic contaminants associated with bacterial action was determined, and the results were used to demonstrate that a Freundlich Isotherm characterized the system, and that bacterial organic solute decay followed a modified first order rate expression. Experimental concentrations were compared with theoretical concentrations derived for internal diffusion and pore diffusion to permit evaluation of diffusion coefficients. Internal diffusion coefficients ranged from 1.6 x 10 to the 9 power sq cm/sec to 2.6 x 10 to the 8 power sq cm/sec while pore diffusion coefficients ranged between 3.4 x 10 to the 9 power and 1.6 x 10 to the 7 power sq cm/sec. Continuous column operation tests are proceeding in attempts to test the validity of the results obtained. (Lowry-Texas)
W71-13526

THEORETICAL ANALYSIS OF ACTIVATED SLUDGE DYNAMICS,
Clarkson Coll. of Technology, Potsdam, N.Y., Dept. of Civil Engineering.
Charles R. Ott, and Richard H. Gogan.
Journal, Sanitary Engineering Division, Proceedings of the American, Society of Civil Engineers, Vol 97, No. SA 1, February 1971, p 1-17, 8 fig, 5 tab, 16 ref.

Descriptors: *Kinetics, *Activated sludge, Organic loading, Flow rate, Mathematical models, Analog computers, Biochemical oxygen demand, Sludge, *Waste water treatment.
Identifiers: *Process control, *Transient response.

The complete mix activated sludge wastewater treatment process was mathematically modeled, and the resulting equations were adapted for use on an analog computer. The mass balance approach was used for the derivation of the mathematical relationships. Once simulated on the computer, the system was subjected to variations of input flow rate, input BOD concentration, and sludge recycle ratios and the response to the different variations was observed. Use of parameters reported in the literature resulted in satisfactory equations for BOD mass escapement rate, and time varying effluent BOD concentration. Steady state BOD output was shown to be controlled primarily by sludge return rate and influent flow rate. However, the effluent BOD concentration was approximately 2 orders of magnitude more sensitive to input flow rate and BOD concentration than to sludge recycle ratio. Transformation of normal varying flow to a constant flow resulted in a 30% decrease in total BOD mass output per day. (Lowry-Texas)
W71-13527

POLYELECTROLYTE CONDITIONING OF ALUM SLUDGE,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
David G. Argo.
Master's Thesis, March 1971, 94 p., 17 fig, 4 tab, 41 ref.

Descriptors: *Lime, *Sludge, *Dewatering, Drainage, Drying, Separation techniques, Flocculation, Mixing, Turbulence, Laboratory tests, Analytical techniques, Hydrogen ion concentration, Chemical oxygen demand, Zeta potential, Cost analyist, Economic feasibility, *Waste water treatment.
Identifiers: *Polyelectrolytes, *Specific resistance, *Chemical bridging, Sand beds, Alum sludge.

Lime sludges, one from a phosphorus precipitation process and one from an excess lime color removal process were conditioned with various polyelectrolytes. Analytical tests included specific resistance, COD, total and volatile solids, pH, and zeta potential. Polyelectrolyte conditioned and unconditioned samples were applied to bench-scale sand beds to determine the effect of conditioning on gravity dewatering and air drying. Specific resistance was determined to be an effective control parameter, and it was reduced significantly only by anionic polyelectrolytes. Sludges so conditioned produced a porous, open floc structure, principally through chemically bridging, which facilitated gravity draining and air drying. Adequate polymer dispersion was required, but excess turbulence destroyed the floc structure. pH was shown to have no detectable effect, whereas the effects of varying solids concentrations were quite noticeable. An average cost of $934 per million gallons of sludge treated was reported, a figure low enough to justify the economic feasibility of the process. (Lowry-Texas)
W71-13530

DISSOLVED OXYGEN CONTROL IN ACTIVATED SLUDGE,
Pacific Engineering Lab. San Francisco, Calif.
R. A. Ryder.
Proceedings, Industrial Waste Conference, 24th, May 6, 7, and 8, 1969, p 238-253, 10 fig, 21 ref.

Descriptors: *Dissolved oxygen, *Activated sludge, *Automatic control, Electrodes, Sampling, Temperature, Pressure, Organic loadings, Chlorination, Protozoa, Bacteria, Flocculation, Electrolytes, Sedimentation, Biochemical oxygen demand, *Waste water treatment, Laboratory tests.
Identifiers: Bulking, *Filamentous bacteria, Polyelectrolytes.

Development of electrochemical sensing elements for dissolved oxygen measurement has ennabled dissolved oxygen levels in wastewater treatment plant aeration tanks to come under the realm of automatic control. A typical DO control system consists of: (1) a DO sensor; (2) DO amplifier; (3) DO recorder and automatic controller; (4) aeration air input controller; and (5) controlled element (such as blower of turbine speed, throttled air valve, or turbine submergence. Associated benefits of DO control include: (1) avoidence of over or under-aeration and corresponding cost savings; and (2) continuous response to changing oxygen demands caused by variations in inflow, waste strength, temperature, barometric pressure, and biological requirements of the mixed liquor. Dissolved oxygen levels can be maintained at plus or minus 0.2 mg/l from a set point. During sludge bulking, adjustment of the DO to .75 mg/l will suppress filamentous organisms causing the bulking. Skimming of secondary/sedimentation tanks and addition of polyelectrolytes to improve settling of bulking sludges are also recommended to improve treatment efficiency. (Lowry-Texas)
W71-13531

ODOR ELIMINATION IN THE FOOD PROCESSING INDUSTRY,
Stone (Ralph) and Co. Inc., Los Angeles, Calif.
R. Stone, and R. L. Kahle.
Proceedings, Industrial Waste Conference, 24th May 6, 7, and 8, 1969. p. 1311-1322, 4 tab, 3 fig, 7 ref.

Descriptors: *Odor, *Treatment, Filters, Carbon, Oxidation, Water pollution sources, Pollution abatement, *Air pollution.

There are four major categories of noxious food-processing odors: (1) Odors associated with organic decomposition; (2) Odors relating to physiological processes; (3) High food odors that are obnoxious in proportion to their concentration; and (4) Odors absorbed into unrelated foods. Odors can be eliminated or reduced by proper processing procedures or by treating the odor bearing gasses. The effects of odors can be reduced by masking agents, neutralizing agents or dilution. Procedures which reduce odors include: (1) cleanliness, (2) fresh raw products, (3) proper storage, (4) rapid processing, (5) rapid removal of wastes, and (6) closed system operation. Air treatment techniques discussed are carbon filters and combustion. Masking and neutralizing odors are discussed in a qualitative fashion. Tall stacks are the primary means of dilution. Costs for the reduction or elimination of noxious odors are presented and discussed. Cost comparisons are avoided due to the diversity of applications and the difficulty in assigning costs to a common parameter. (Goessling-Texas)
W71-13532

APPLICATION OF THE CONTINUOUS CULTURE THEORY TO THE TRICKLING FILTER PROCESS,
Georgia Inst. of Tech., Atlanta.
B. H. Kornegay, and J. F. Andrews.
Proceedings, Industrial Waste Conference, 24th, May 6, 7, and 8, 1969, p 1398-1425, 17 fig, 26 ref.

Descriptors: *Waste water treatment, *Trickling filters, *Mathematical models, *Design, Kinetics.
Identifiers: Plug flow, Reactors in series.

The need for a rational approach to trickling filter design is apparent from a review of the literature. It has been shown that existing design equations provide filter volumes that vary by a factor of more than ten when designed for the same effluent quality. A mathematical model of a trickling filter has been developed based on the known facts and the assumptions that : (1) plug-flow is achieved in the liquid phase; (2) substrate utilization by microorganisms in suspension is neglible; (3) the apparent yield remains constant with depth; and, (4) removal is described by a saturation function which incorporates the effect of diffusion and growth rate. This model uses the kinetics of fixed microbial films previously described by Kornegay and Andrews and the Monod growth relation for single stage reactors. It has been determined by laboratory experiments that six completely mixed annular reactors in series can simulate the operation of a trickling filter, and demonstrate some of the mechanisms of such filters. Much remains to be done, however, it is felt that the proposed mathematical model provides an insight into the mechanisms of organic waste removal by trickling filters that was not previously available. Design parameters such as depth, cross-sectional area, flow rate and specific surface area of the media are related to the biomass and the rate of substrate removal. (Goessling-Texas)
W71-13535

COST OF TREATMENT OF WASTEWATER WITH PARTICULAR REFERENCE TO THE RIVER SYSTEM OF THE TRENT AREA,
Water Pollution Research Lab., Stevenage (England).
K. S. Porter, and A. G. Boon.
Paper 3B, Symposium on the Trent (River) Research Programme, University of Nottingham, 15-17 April 1971. 14 p, 5 fig, 8 tab, 13 ref, (Water Pollution Research Laboratory Reprint No. 622).

Descriptors: *Water management, *Waste water treatment, *Water quality, Sewage effluent, River system, Cost analysis, Costs, Effluents, Sewage treatment, *Effluent streams.
Identifiers: *Treatment costs, *Trent River (England).

In studying the economics of the management of river water quality it is of importance to obtain accurate figures for the cost of treating waste waters in addition to specifying the quality of effluents for discharge into the river. The methods by which this information was estimated for the investigation being carried out as a part of the Trent River Programme. The cost of treatment is related to the flow and composition of the waste water, the method of treatment, the method of sludge disposal, and the quality of the effluent produced. Future flows for sewage were estimated based on past and present experience. Composition of the sewage was predicted by each local authority based on experience, existing discharges of sewage and industrial wastewaters, and predicted water consumption. Three levels of effluent quality were established to cover the range of alternatives likely to be adopted by the Trent River Authority. Sewage treatment works to treat the estimated flows with the predicted composition to the desired quality effluent were costed. The result is a table of costs for waste water treatment to each of three levels of quality for the years out to 2000. (Goessling-Texas)
W71-13542

NITROGEN AND PHOSPHOROUS REMOVAL: METHODS AND COSTS,
Water Pollution Research Lab., Stevenage (England).
R. W. Bayley.
Water Treatment and Examination, Vol 19, 1970. p 294-319, 5 fig, 11 tab, 57 ref, (Water Pollution Research Laboratory Reprint 613).

Descriptors: *Waste water treatment, *Nitrogen, *Phosphorous, Nitrosomonas, Nitrobacter, Chemical precipitation, Ion exchange, Costs, Nutrients, Cost comparisons.
Identifiers: *Nutrients removal, Air stripping.

In some parts of Western Europe and the USA where eutrophication of surface waters has been a problem, methods of removing nutrients, phosphorous and nitrogen, from effluents have been studied extensively. A few full-scale plants now discharge treated effluents with low concentrations of these elements. Most of these methods could be applied in Britain if the cost-benefit analy-

sis proved favorable. Several processes for removing phosphorous are presented and discussed: biological treatment, chemical precipitation and selective ion exchange. Processes for removing nitrogen from waste waters are presented and discussed: biological treatment, nitrification and denitrification, air stripping and ion exchange. Costs for these processes are estimated and the efficiencies to be expected are presented. Advanced treatment processes, reverse osmosis, distillation and electrolysis are mentioned briefly. Long term prospects favor enhancing biological treatment, especially nitrification followed by denitrification, to remove nutrients. However, there is great interest in the development of non-biological waste treatment systems and physico-chemical processes may be used to a greater advantage in one of these. (Goessling-Texas)
W71-13544

WATER POLLUTION STUDY (DENITRIFICATION),
Sunflower Army Ammunition Plant, Lawrence, Kans.
Thomas M. Gilkison.
Available from the National Technical Information Service as AD-724 866, $3.00 in paper copy, $0.95 in microfiche. Final Report on DA-11-173-AMC-42 (A), April 30, 1971. 67 p, 9 fig, 14 tab, 9 ref.

Descriptors: *Nitrification, Eutrophication, *Nitrates, Bacteria, Anaerobic conditions, Metabolism, Laboratory tests, Pilot plants, Temperature, Hydrogen ion concentration, Cost analysis, Sludge, *Waste water treatment, Kansas, *Denitrification.
Identifiers: Methanol, *Lawrence (Kansas), Nitrate nitrogen.

The Sunflower Army Ammunition Plant (SAAP) at Lawrence, Kansas discharges 10-15 thousand pounds per day of waste nitrates into a tributary stream of the Kansas River. Laboratory and pilot plant biological denitrification studies were conducted on both batch and continuous operations. Sewage and sludge from the Imhoff tanks from the SAAP sewage system were used as sources of bacteria to treat neutralized waters containing 100 to 230 mg/l of nitrate nitrogen. Effects of temperature and pH were monitored in all phases of the experiment. Good nitrate removals were obtained. Removal was temperature dependent to the extent that while 99 plus% removal could be obtained at temperatures in excess of 85F, only 72% was removed when the temperature dropped to 44. A reactor loading of 0.15 pounds of NO3-N/day/lb VSS, was found to be a conservative value. Chemical cost for methanol was found to be $0.082/1000 gal. for a wastewater with a concentration of 100 mg/l NO3-N. (Lowry-Texas)
W71-13545

CALCULATION OF THEORETICAL YIELDS OF ROTARY VACUUM FILTERS,
Water Pollution Research Lab., Stevenage (England).
R. S. Gale.
Journal of the Institute of Water Pollution Control, No 1, p 3-7, 1971. 2 fig, 2 tab, 4 ref, (Water Pollution Research Laboratory Reprint 620).

Descriptors: *Vacuum drying, *Waste water treatment, Equations, Forecasting, *Filters, Sludge, Treatment facilities.
Identifiers: *Sludge yields, Nomographs, *Vacuum filters, Rotary filters.

An equation developed previously by others has been shown to predict vacuum filter yields within 30 percent under certain conditions. Calculations are simple, yet great care is required in the arithmetical computations. A simplified equation is developed for sludges with a compressibility coefficient of unity which permits predictions to be made using data obtained from the standard method of measuring specific resistance at 49 kN/m2. A nomograph for rapid solution of the simplified equation is presented. Both equations are to be relied upon only when the specified conditions are satisfied. In spite of the limitations, the equation can serve as a useful yardstick for measuring plant performance. (Goessling-Texas)
W71-13547

PILOT PLANT EVALUATION OF BIOLOGICAL TREATMENT OF INTEGRATED KRAFT PULP AND PAPER MILL EFFLUENTS,
Associated Water and Air Resources Engineer's Inc., Nashville, Tenn.
Thomas H. Patton, Jr., and Karl C. Ayers.
Chemical Engineering Progress, Symposium Series, Vol 67, No 107, p 432-434, 1971. 1 fig, 1 tab, 7 ref.

Descriptors: *Pulp wastes, *Biological treatment, *Aeration, Oxidation, Dewatering, Effluents, Biochemical oxygen demand, Hydrogen ion concentration, Nutrients, Trickling filters, Sludge, *Waste water treatment, Industrial wastes.
Identifiers: Influent, Clarifier.

A project was undertaken which involved the study of several biological treatment processes on particular effluents from the integrated kraft pulping, bleaching and papermaking operation of the Mead Corporation in Chillicothe, Ohio. The biological systems under study included 2 high rate trickling filters packed with P.V.C. media, an oxidation ditch with brush type aeration, and an earthen lagoon with mechanical surface aeration. All pilot systems were built large enough so the effect of scale would be minimized. Each trickling filter contained 16 sq. ft. of top surface area and stood 24 ft. The oxidation ditch and aerated lagoon systems had capacities of 150,000 gal. with flow rates from 20 gal/min-100 gal/min. Throughout 4 test periods, 59 tests were conducted for 4 pilot treatment processes. These tests utilized routine testing procedures in addition to long term BOD's, nutrient concentrations added and remaining BOD5 of settled effluent, oxygen uptake rates, flow velocities in aeration basins and hydraulic tracer studies. A final conclusion of this project cannot be stated until all data is analyzed, but the principal objectives involved were: (1) the effects of influent solids and organics on biological treatment efficiencies, (2) potential of plastic trickling filters as main process for biological treatment, (3) evaluation of secondary clarification and sludge return and (4) the evaluation of methods of treatment in providing higher levels of organic and solids removal. (Gutierrez-Texas)
W71-13548

ANALYTIC AND PROCESS CLASSIFICATION OF WASTE WATERS,
Connecticut Univ., Storrs.
THEODORE Helfgott, J. V. Hunter, and W. A. Duvel, Jr.
Chemical Engineering Progress, Symposium Series, Vol 67, No 107, p 388-400, 1971. 8 fig, 3 tab, 18 ref.

Descriptors: *Waste water treatment, *Biological treatment, *Water purification, Chemical analysis, Ion exchange, Filtration, Turbulence, Hydrogen ion concentration, Reverse osmosis, Adsorption, Aerobic, Chemical oxygen demand, Biochemical oxygen demand, Activated carbon, Turbidity, Nutrients, Sewage, Effluents, *Industrial wastes, *Electrodialysis.
Identifiers: *Gravitational electrodialysis, Hyperfiltration, Anions, Cations, Total organic carbon, Total volatile solids, Organics.

Two classification techniques used in assessing industrial wastewaters to determine appropriate treatments are used to determine either the constituents of the wastewater by chemical analysis or the physical and chemical interactions of the constituents of the wastewater by applying process techniques. A study was made on the chemical and process response of the residual organics found in two industrial wastewaters. One of the wastewaters was a composite studied for a proposed combined municipal and industrial wastewater treatment plant for a regional river basin area. The other wastewater was from the manufacture of a single material, a dye. An objective of the work was to evaluate the organics present through a technique using electordialysis/electrophoresis to fractionate these organics by ionic charge and tendency to align in a pH profile. This technique is called Gravitational Electrodialysis. Its application is the analytic and process classification of the composite wastewater and the saline dye wastewater, where Gravitational Electrodialysis is used with other physical and chemical processes. The process response of the organics to this technique indicates something of their chemical nature and reveals directly useful information on which feasible treatment systems could be based. (Gutierrez-Texas)
W71-13549

THE UTILIZATION OF LIME SLUDGES CONTAINING PHOSPHATES,
Monsanto Research Corp., Dayton, Ohio.
Robert E. Opferkuch, Tom Ctvertnicek, Michael G. Konicek, and Sunil M. Mehta.
Chemical Engineering Progress, Symposium Series, Vol 67, No 107, p 288-293, 1971. 6 fig, 5 tab.

Descriptors: *Phosphates, *Lime, *Sewage treatment, Sludge, Oxides, Effluents, Hydrogen ion concentration, Variability, Adsorption, *Waste water treatment, Chemical precipitation.
Identifiers: *Secondary effluent, Calcined sludge.

A brief review was presented of part of a study sponsored by the U. S. Department of the Interior, Federal Water Quality Administration. The study demonstrated that the addition of lime to the effluent from secondary sewage treatment can effectively remove soluble phosphates by precipitating them as the insoluble calcium salts. Such treatment removes hardness, some residual organic matter, and other diverse materials by precipitation and/or adsorption obtaining a high-quality water. Also, a considerable amount of sludge formed contains a variety of materials, most common of which are Ca (PO4)2, CaCO3-Ca (OH)2 and Mg (OH)2. The main question of the study was, 'What could be done with the sludge.'. A review of sludge utilization was conducted. Considered alternatives included conversion of the sludge to products with known market value and use 'as is' in agricultural applications. (Gutierrez-Texas)
W71-13550

REMOVAL OF ORGANICS FROM WASTEWATER BY ACTIVATED CARBON,
Federal Water Quality Administration, Pomona, Calif.
John N. English, Arthur N. Masse, Charles W. Garry, Jay B. Pitkin, and James E. Haskins.
Chemical Engineering Progress, Symposium Series, Vol 67, No 107, p 147-153, 1971. 10 fig, 2 tab.

Descriptors: *Waste water treatment, *Organic matter, *Activated carbon, Activated sludge, Carbon, Chlorination, *Chemical oxygen demand, Adsorption, Filtration, Effluents, Economics, Sludge treatment, California.
Identifiers: *Secondary effluents, *Biological oxidation, Biological denitrification, Regeneration, *Pomona (Calif).

The Federal Water Quality Administration and the Los Angeles County Sanitation Districts operate an Advanced Waste Treatment Research Facility on the grounds of the Pomona Water Renovation Plant in Pomona, California. The objective is the development of the minimum cost technology capable of renovating wastewater. In order to attain the objective a 0.3 million gal./day, four stage, fixed bed, granular activated carbon pilot plant was tested and evaluated. The plant, equipped with thermal regeneration facilities, continuously treated unfiltered activated sludge wastewater treatment plant effluent for a four year period. High-quality product water characterized by a COD of 10 mg/liter was produced on a routine ba-

sis. A 17% decrease in carbon capacity occurred between the first and fourth cycles (one cycle/year) where a state condition was established at a capacity between 45-50 lb. of dissolved COD/100 lb of carbon. Regeneration of the carbon was shown to be a feasible process and successful backwashing of the first stage carbon, which serves as a filter and an adsorber, made pretreatment of the wastewater treatment plant effluent unnecessary. An estimated cost of $86/mil. gallons, for a 10 mil. gal./day carbon plant is based on a fourth cycle dosage of 350 lb carbon/mil gallons of water and a conservative carbon loss of 10%/cycle. (Gutierrez-Texas)
W71-13551

PROCESS EQUIPMENT DESIGN IN WASTEWATER RENOVATION,
Burns and Roe Inc., Oradell, N.J.
J. L. Rose.
Chemical Engineering Progress, Symposium Series, Vol 67, No 107, p 63-88, 1971. 6 fig, 3 tab.

Descriptors: *Wastewater treatment, *Activated sludge, Trickling filters, *Water reuse, Water pollution, Anaerobic digestion, Effluents, Sedimentation, Flotation, Filtration, Carbon, Coagulation, Phosphates, Economics, New York, Tertiary treatment, Treatment facilities, Design.
Identifiers: *Biochemical processes, *Industrial reuse, Nassau County (NY).

The Bay Park Sewage Treatment Plant, Nassau County, Long Island, New York, has developed a process sequence and equipment design for wastewater renovation. A plant has been in operation for 18 mo. Renovated water has been injected for continuous periods up to 10 days with only minor clogging and nearly original well capacity. The product water is physically indistinguishable from water in the aquifer, although chemical analysis could detect some changes due to passage through a municipal system. However, the water would be suitable for many forms of direct industrial reuse. The project has demonstrated the crucial roles played by both the government and the engineer in making the concept of water renovation for reuse a reality. (Gutierrez-Texas)
W71-13552

OXYGEN MICROPROBE STUDIES OF MICROBIAL SLIME FILMS,
Federal Water Quality Administration, Athens, Ga. Southeast Water Lab.
W. M. Sanders, III., H. R. Bungay, III., and W. J. Whalen.
Chemical Engineering Progress, Symposium Series, Vol 67, No 107, p 69-74, 1971. 10 fig, 8 ref.

Descriptors: Water pollution control, *Waste water treatment, Microorganisms, Kinetics, Biochemical oxygen demand, Chemical oxygen demand, Nutrients, Adsorption, *Trickling filters, Filtration, *Oxygen demand.
Identifiers: *Microbial slime, *Metabollic waste, Photomicrographs, Electron micrographs.

In some rivers and streams, biological slimes exert a major demand on the oxygen resources and attached growth has been employed for many years for waste treatment by trickling filters of various designs. In this particular study microbial slimes were grown from trickling filter inoculum in a flow chamber fed sterile, dilute, air saturated medium. Photo micrographs and electron micrographs were taken of sections of slime. Films reaching a thickness of 100 micron, were analyzed for dissolved oxygen by positioning a D. O probe above the slime surface and taking readings as the probe moved through the film. These films had some oxygen depletion in the outer layers but were aerobic throughout. Changing to medium low in dissolved oxygen resulted in a rapid reduction in oxygen concentration near the surface of the film, however, lower layers were slow to change. Flushing the films with oxygen rich, concentrated medium caused a rapid decline in oxygen concentration, no matter where the probe was positioned in the film. Inner zones of microbial slimes were also substrate limited or oxygen limited, while organisms present are able to resume rapid respiration with little delay. Well-known diffusion equations can be applied to the steady state oxygen profiles and to transient response data to estimate diffusivity of oxygen and oxygen uptake rates in the slimes. (Gutierrez-Texas)
W71-13554

PHOSPHOROUS UTILIZATION BY THE MICROORGANISMS OF ACTIVATED SLUDGE,
Arizona Univ., Tucson.
Irving Yall, Norval A. Sinclair, William H. Boughton, Richard C. Knudsen, and William C. Lafferty.
Chemical Engineering Progress, Symposium Series, Vol 67, No 107, p 95-99, 1971. 6 tab, 15 ref.

Descriptors: *Phosphorous, *Activated sludge, *Microorganisms, *Waste water treatment, Biological treatment, Aeration, Bacteria, Flocculation, Sewage, Temperature, Arizona.
Identifiers: *Gram-negative isolates, Pseudomonas-Xanthomonas, Alcaligenes, Escherichia, Aerobacter, Flavobacterium, Achromobacter, Tucson (Ariz).

Microorganisms of activated sludge play an important role in the stabilization of organic wastewaters. Eighty-five pure bacterial cultures were isolated from activated sludge obtained from the Tucson Municipal Wastewater Treatment Plant. 78 of these were gram-negative, nonsporeforming, rod shaped bacteria. The gram-negatives were isolated into 5 groups: (1) Pseudomonas-Xanthomonas, (2) Alcaligenes, (3) Escherichia-Aerobacter, (4) Flavobacterium, and (5) Achromobacter. Isolation of members of the Escherichia-Aerobacter group was enhanced when enrichment media containing glucose was used. All 78 gram-negatives were screened for their ability to remove H3 32PO4 radioactivity from sewage in 6 hours. Members of the Pseudomonas-Xanthomonas group were high 32P removers and members of the Escherichia-Aerobacter group were low removers. When 0.1% glucose was added to the sewage, members of the Escherichia-Aerobacter group became high phosphate removers. (Gutierrez-Texas)
W71-13555

CONTINUING STUDIES IN THE REMOVAL OF PHSOPHOROUS BY THE ACTIVATED SLUDGE PROCESS,
California State Dept. of Public Works, Los Angeles. Bureau of Sanitation.
Robert D. Bargman, Jack M. Betz, and William F. Garber.
Chemical Engineering Progress, Symposium Series, Vol 67, No 107, p 117-121, 1971. 7 fig, 3 tab, 14 ref.

Descriptors: *Phosphorous, *Activated sludge, *Secondary treatment, Aeration, Effluent, Hydrogen ion concentration, Precipitation, Enzymes, Oxygen, *Waste water treatment.
Identifiers: *Hyperion treatment, Metabolic uptake, Influent, Stripping.

During the period from April 1969-July 1970, 100 mil. gal/day of waste water have been processed in the secondary treatment system of the Hyperion treatment plant of the city of Los Angeles reducing the phosphorous content of the effluent from 10 to 1.8 mg/liter. Emperical controls for the hyperion plant have been developed and the process has proven to be repeatable and controllable. There is indication that a plug flow configuration is desirable for the process and a stoichiometric balance between cations and phosphate anions can be obtained if certain reactions are assumed. However, laboratory work has shown the hyperion activated sludge to be unique in its ability to remove phosphorous. In studying this sludge process it is evident that the characteristics of the sludge are important, since the basic reaction may be an enzymatic one. (Gutierrez-Texas)
W71-13556

ULTIMATE DISPOSAL OF PHOSPHATE FROM WASTEWATER BY RECOVERY AS FERTILIZER,
Grace (W.R.) and Co., Lake Zurich, Ill. Dearborn Chemical Div.
Murrell L. Salutsky, Maria G. Dunseth, Kenneth M. Ries, and Joseph J. Shapiro.
Chemical Engineering Progress, Symposium Series, Vol 67, No 107, p 54-62, 1971. 3 fig, 10 tab, 13 ref.

Descriptors: *Waste water treatment, *Fertilizer, *Phosphates, Hydrogen ion concentration, Nitrogen, Biochemical oxygen demand, Chemical oxygen demand, Effluent, *Activated sludge, Solubility, Precipitation, Temperature, *Waste disposal.
Identifiers: *Digester supernatant liquor, Orthophosphates.

The operation of a conventional activated sludge waste treatment plant usually produces side waste streams containing phosphorus in higher concentrations than the incoming wastewater. At present there are not advanced waste treatment processes allowing for removal and ultimate disposal of phosphorus at a cost within the economic parameters required for general use. Many of the proposed processes reducing orthophosphate in the effluents from waste treatment plants result in extracted phosphate being concentrated in the digester. The increased phosphate must be removed prior to disposal of the supernatant. A new process designed for the removal of phosphate from digester supernatant is based on the thermal-vacuum decomposition of ammonium bi-carbonate in the supernatant. The process is applicable in most areas except those of very soft water where a supplemental source of magnesium might be required. Ultimate disposal of phosphate is achieved by its separation and recovery as a salable fertilizer containing magnesium ammonium phosphate and also containing a relatively high percentage of plant food. Although this process is not limited by the size of the city, recovery as a fertilizer is feasible only for the larger cities, since the quantity produced in small cities is insufficient for economical operation of a fertilizer plant. (Gutierrez-Texas)
W71-13557

DISPOSAL OF LIQUID AND PARTICULATE WASTES TO THE OCEAN,
Federal Water Pollution Control Administration, Corvallis, Oreg. Pacific Northwest Water Lab.
P. J. Baumgartner.
Chemical Engineering Progress, Symposium Series, Vol 67, No 107, p 46-53, 1971. 10 fig, 25 fig.

Descriptors: *Biological treatment, *Liquid wastes, *Waste water treatment, Land clearing, Ocean circulation, Sedimentation, Coastal structures, Water pollution control, Stratification, Aquatic drift, DDT, Waste disposal.
Identifiers: Particulate wastes, Linear gradient, Ambient flow, Ambient density.

Pipelines are used to transport wastes through short distances in lakes and oceans as compared to transport distances over land. However, construction and maintenance problems have limited them to several miles. Due to large volumetric flow rates involving 6.5 cu. m./sec for a city of a million people, barges or tankers cannot economically compete on short hauls. Discharge points must be established offshore (20-200 Km.) so that pipelines can be economically feasible. The final determination constituting an acceptable discharge point depends on the oceanographic features of current, depths, waves, and storms. The Federal Water Pollution Control Administration is interested in the terminal structures of pipelines because of their influence on the fate of waste streams. The structures involved include open-ended pipes, elbows, reducers,

elaborately formed bonnets, multiple-port manifolds or diffusers and elongated slots. The primary intention with many of these designs is maximum initial dilution of the waste stream, although objectives such as submergence or surfacing can be optimized. (Gutierrez-Texas)
W71-13558

WATER, SEWER AND DRAINAGE PLAN, COMPREHENSIVE PLANNING STUDY, BLYTHEVILLE-GOSNELL, ARKANSAS.
Ellers, Reaves, Fanning and Oakley, Engineers; and Manes and Associates, Inc.
For primary bibliographic entry see Field 06B.
W71-13566

REPORT ON OPERATIONS CONTROL CENTER FOR THE WATER UTILITY DEPARTMENT OF THE CITY OF DALLAS, TEXAS.
Black and Veatch Consulting Engineers, Kansas City, Mo.
For primary bibliographic entry see Field 05F.
W71-13567

PREVENTION AND CORRECTION OF EXCESSIVE INFILTRATION AND INFLOW INTO SEWER SYSTEMS, MANUAL OF PRACTICE.
American Public Works Association, Chicago, Ill.
For primary bibliographic entry see Field 08A.
W71-13568

WATER TREATMENT PROCEDURES USED ON SOME SOUTH AFRICAN MINES,
Anglo-American Corp. of South Africa, Johannesburg.
D. J. Boxman, and D. D. Marsden.
South African Journal of Science, Vol 67, No 3, p 218-223, March 1971. 4 fig.

Descriptors: *Water purification, *Underground, *Flocculation, *Chemical analysis, *Mine water, Effluents, Sewage effluents, Filtration, Cooling water, Boiler feed water, Water quality, *Waste water treatment.
Identifiers: *South Africa.

Water treatment procedures used by the mines of the Anglo-American Corporation may be divided into 4 main divisions: (1) purification of water for human consumption and general use; (2) underground flocculation for reduction of pump wear, and where water is reused, for reduction of dust levels; (3) chemical conditioning for use in boilers and cooling circuits; and (4) effluent measures, including flocculation and settling, chemical conditioning and biological filtration processes. Where water purification procedures are necessary, the 'floc blanket' method is used in which larger particles trap smaller ones. Principal flocculants used and their various drawbacks are discussed. The typical underground water reticulating system is diagrammed. Such water responds very well to flocculation with anionic or non-ionic polyacrylamides, but because of variations in layouts, each installation has to be tested individually to determine optimum dosage rates and points of addition. Internal boiler treatment is used because of its simplicity and it is common practice for the boiler filters to undertake chemical analyses and to regulate the treatment from their results. The internal treatment is uneconomical where very hard water must be used. The most common type of cooling systems are the open, recirculating type, using water-cooled compressors. Underground systems encounter difficulties from acidification due to oxidation and dissolution of exposed pyrites. The major problems of effluent use involve acidic or saline impurities, and a number of methods in use for combatting these problems are described. (Casey-Arizona)
W71-13578

NEW AND USED WATER FOR INDUSTRIAL NEEDS - WHERE AND WHEN,
Ford Motor Co., Detroit, Mich. Facility Environment Control Section.
For primary bibliographic entry see Field 03C.
W71-13652

USING SOIL FILTRATION TO REDUCE POLLUTION POTENTIAL OF LAGOON EFFLUENT ENTERING GROUND WATER SYSTEM,
Iowa State Univ., Ames.
C. E. Beer, and J. K. Koelliker.
Available from the National Technical Information Service as PB-203 348, $3.00 in paper copy, $0.95 in microfiche. Iowa State Water Resources Research Institute, Ames, Completion Report ISW-RRI-41, August, 1971. 32 p, 4 fig, 2 tab, 23 ref. OWRR A-021-IA (1).

Descriptors: *Irrigation efficiency, *Denitrification, *Nitrogen, *Farm wastes, Chemical oxygen demand, *Nitrates, Ammonia, *Lagoons, Waste treatment, *Waste disposal, Anaerobic conditions, *Waste water treatment, Application, *Effluents, Iowa, Biochemical oxygen demand, Chemical oxygen demand, *Phosphorous, Organic matter, *Filtration, Infiltration, *Soil profiles, Sprinkling.
Identifiers: *Soil filtration.

Swine lagoon effluent was applied to soil for final treatment. The active soil profile appears to offer great potential as a final treatment media for partly treated animal wastes and cattle feedlot runoff. Effluent sprinkled on a grass-covered soil profile reduced COD, nitrogen, and phosphorus concentrations 79-95, 40-80, 95-99 percent, respectively over a 3-year period. Loadings ranged from 13.9 to 48.1 in. of lagoon effluent per May-October season. Removal of COD was attributed to biological activity and physical filtration in the upper inches of the soil. Phosphorus reduction resulted from chemical activity of the clay fraction near the soil surface. Nitrogen reduction was attributed primarily to denitrification deeper in the soil profile. The organic matter in the soil served as the carbon source for denitrification rather than the lagoon effluent. Organic matter content of the lower region of the soil profile was reduced and nitrogen removal by denitrification decreased. For disposal fields that are operated primarily for BOD removal, about 24 in. per year can be applied in most areas of Iowa. In areas where nitrate concentration in the percolate is of concern, applications should be limited to 600 lb/acre of nitrogen per season.
W71-13656

GRANTS FOR CONSTRUCTION OF TREATMENT WORKS, LIMITATIONS.
Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 06E.
W71-13705

POLLUTION CONTROL--FINANCING.
For primary bibliographic entry see Field 06E.
W71-13712

SEWAGE DISPOSAL FROM PLEASURE BOATS,
Michigan Univ., Ann Arbor. Dept. of Naval Architecture and Marine Engineering.
For primary bibliographic entry see Field 05G.
W71-13736

OXIDATION DITCH IN CAGE LAYER HOUSE.

Poultry Digest, July 1971. p 337.

Descriptors: *Poultry, *Farm waste, Bacteria, Odor, Foaming, Water circulation, Solids, Waste treatment, Biochemical oxygen demand, *Waste water treatment, *Oxidation lagoons.
Identifiers: *Manure water mixture, Feathers, Mechanical failure, Cage laying house, Oxidation ditch.

An oxidation ditch under a laying flock presented no major problems during a two year study. This was a study made on a 936 bird caged flock in Northern Ireland. The oxidation ditch is 68 feet long with a channel width of 44 inches. The liquid depth is maintained between 3 1/4 to 3 1/2 feet deep for an approximate capacity of 1.8 cubic feet per bird. Waste production of the birds averaged 254 pounds per day with a biological oxygen demand of the fresh droppings of 40,860 parts per million. This was a daily B.O.D. load on the ditch of 10.3 pounds. It was necessary to empty the ditch completely when the solids content of the liquid rose above the 30,000 ppm level - about twice a year. Bacterial activity in the ditch during the first cycle of storage was responsible for loss of 43% of the total solids, 60% of the chemical and biological oxygen demand, and 66% of the nitrogen. The manure water mixture in the ditch was odorless. (Bundy-Iowa State)
W71-13785

COMPARISON OF MEDIA FOR ISOLATION OF SALMONELLAE AND SHIGELLAE FROM FECAL SPECIMENS,
Center of Disease Control, Atlanta, Ga. Enteric Bacteriology Unit.
C. Dunn, and W. J. Martin.
Applied Microbiology, Vol 22, No 1, p 17-22, July 1971. 5 tab, 38 ref.

Descriptors: *Salmonellae, *Shigellae, *Pathogenic bacteria, Laboratory, Enteric bacteria, Bacteria, Isolation, Waste treatment.
Identifiers: Transport media, Plating media, Enrichment broth media, Bacteria population, Clinical specimens, Isolation rate, Recovery rate.

Five transport media, eight plating media, and three enrichment broth media for the isolation of salmonellae and shigellae were evaluated. Eight laboratories in widely separated regions of the United States participated in this evaluation by submitting 490 fecal specimens in the transport media provided. The results suggest that the newer transport media may not offer any advantage over the use of buffered glycerol-saline in the isolation of these enteric pathogens. Shigellae were best isolated by direct inoculation, whereas salmonellae were isolated in greater numbers after tetrathionate (without Brilliant Green) enrichment with subsequent culturing on the plating medium. The use of a variety of plating media is recommended for the recovery of a larger number of these enteric pathogens. (Bundy-Iowa State)
W71-13787

CORYNEFORM BACTERIA IN POULTRY DEEP LITTER,
Edinburgh Univ. Dept. of Bacteriology.
For primary bibliographic entry see Field 05A.
W71-13789

TREATMENT OF LONG ISLAND DUCK FARM WASTES,
Cornell Univ., Ithaca, N.Y. Dept. of Sanitary Engineering.
Charles D. Gates.
Journal Water Pollution Control Federation, Vol 35, No 12, December 1963, p 1569-1579. 7 fig, 2 tab, 16 ref.

Descriptors: *Ducks, *Chlorine, *Coliforms, *Water management, *Chlorination, Farm wastes, Water pollution, Biochemical oxygen demand, Lagoons, Sludge, Waste disposal, Laboratory tests, Microorganisms, Salmonella, Effluents, Shellfish, Waste treatment, Oxidation lagoons.
Identifiers: Residual coliform densities, Underwater lagoon, Most probable number.

The presence of year round duck farms in the Moriches Bay area has resulted in pollution which interferes with other legitimate uses of these waters. A study was made and the results are reported in this paper. The conclusion is that the successful disinfection of duck farm lagoon effluents by chlorination would require a number of addi-

tions to, and changes in, present treatment practice. These would include (1) a separate basin to provide 15 minute contact time between the chlorine and the settled effluent; (2) facilities for adding the chlorine and thoroughly mixing it with the effluent; (3) some means of dose and/or residual control of the chlorination by the farm operator; (4) some administrative means of ensuring compliance with this required treatment. (Hazen-Iowa State)
W71-13791

METHODS FOR DISPOSAL OF POULTRY MANURE,
New Zealand Dept. of Agriculture, Christchurch.
P. D. Thompson.
New Zealand Journal of Agriculture, Vol 116, No 1, January 1968, p 44-49. 2 tab, 5 fig.

Descriptors: *Poultry, Fertilizer, Oxidation lagoons, Irrigation efficiency, Solid waste drying, Market value, Weight, Chemical analysis, Larvae, Waste treatment, Waste disposal.
Identifiers: *Cage, Broiler, Sewage sludge, Indoor lagoon, Droppings, Offensive smell, Breeding ground.

The disposal of poultry manure in its various forms can cause problems by the spread of the urban settlement. Disposal of poultry manure should be divided into three stages: the collection of droppings; the removal of the droppings; and the disposal or processing. The volume of poultry manure per 1000 laying birds per week is approximately 32 cubic feet per ton with a moisture content of 70 per cent. Approximately fifty acres of grassland is required to dispose of the annual manure produced from 2500 deep litter layers or 20,000 broilers. Sludge disposal is another method of handling manure. To handle the manure from 1000 birds at a dilution of 1:1, a holding capacity of 10 to 18 cubic feet per day is required. Most of these storage tanks do not exceed 1000 cubic feet. The disposal by irrigation is one of the common practices of emptying these tanks. Still another method of disposal is the lagoon. A newer method of disposal is drying the manure. This method is expensive, and therefore requires a sure market to be practical. Poultry farmers should realize the many profitable alternatives for the disposal of manure. (Bundy-Iowa State)
W71-13792

POMME DE TERRE LAKE BACTERIOLOGICAL STUDY (MISSOURI),
Environmental Protection Agency, Kansas City, Mo.
For primary bibliographic entry see Field 05B.
W71-13814

REPORT ON LA JUNTA, COLORADO TECHNICAL ASSISTANCE PROJECT, SEPTEMBER 21-OCTOBER 4, 1970 AND OCTOBER 13-OCTOBER 19, 1970.
Federal Water Quality Administration, Kansas City, Mo. Missouri Basin Region.

Report, October, 1970. 31 p, 2 fig.

Descriptors: *Operation and maintenance, *Aerobic treatment, *Treatment facilities, *Sewage treatment, Municipal waste, Industrial wastes, Test procedures, Colorado, Operations, Control.
Identifiers: La Junta (Colorado), Arkansas River.

The technical assistance provided to the City of La Junta is summarized. A description of the area and a description of the waste sources including the canning factory are given. The La Junta wastewater treatment facilities are described as well as the operation prior to the Federal technical assistance. The report outlines operation after assistance was provided and outlines recommendations for maintaining and improving operational practices. (Hegg-EPA)
W71-13817

THE CASE FOR BETTER WASTE TREATMENT,
Environmental Protection Agency, Kansas City, Mo.
John M. Rademacher, Carl V. Blomgren, and Carl Walter.
January 1971. 32 p, 5 tab, 9 fig.

Descriptors: *Missouri River, *Treatment facilities, *Sewage treatment, Coliforms, Salmonella, *Sewage bacteria, Enteric bacteria, Periphyton, Aquatic bacteria, Taste, Indicators.
Identifiers: Fish flesh tainting.

Unique investigations of the Missouri River designed to provide support for a Federal policy of secondary treatment with bacterial control are summarized. Included in the narrative is description of the quality paramenters used and the interrelationships developed from the data. The specific investigations described are: (1) Bacteriological indicator organisms-fecal coliform and fecal streptococci; (2) Bacterial pathogen salmonella; (3) Enteric virus; (4) Fecal sterol-coprostanol; and (5) Specialized biological studies - periphyton and fish flesh tainting. The report shows the use of indicators to trace the fate of waste effluents, the presence of pathogens which are a hazard to water users, the effects of wastes on the aquatic brata and the potential mitigating effect of secondary waste treatment with bacterial control. (Walter-EPA)
W71-13818

FEDERAL ASSISTANCE PROJECT METROPOLITAN DENVER SEWAGE DISPOSAL DISTRICT NO. 1. OCTOBER 1969 - FEBRUARY 1970.
Environmental Protection Agency, Kansas City, Mo.
Bob A. Hegg, and John R. Burgeson.
March 1971, 42 p, 5 tab, 6 fig, 12 ref.

Descriptors: Activated sludge, Kinetics, Sewage sludge, Settling velocity, Operations, Settling basins, Colorado, Sewage treatment, Waste water treatment, Model studies.
Identifiers: Denver (Col).

The report outlines the assistance provided to the Metropolitan Denver Sewage Disposal District No. 1. Procedures and results are summarized for the control testing, data analyses plant performance, control of sludge characteristics, and plant control. Data were analyzed using the kinetic model to determine sludge production characteristics, which were greater than those of normal domestic waste. Also an analysis of the clarification and thickening capacities of the final clarifiers was made and it was concluded that with the obtained sludge settling characteristics, the clarifers were not adequate. (Hegg-EPA)
W71-13820

EVERYONE CAN'T LIVE UPSTREAM: A CONTEMPORARY HISTORY OF THE WATER QUALITY PROBLEMS ON THE MISSOURI RIVER- (SIOUX CITY, IOWA TO HERMANN, MISSOURI),
Environmental Protection Agency, Kansas City, Mo.
Carl Walter.
April 1971. 295 p, 35 tab, 4 fig, 28 ref.

Descriptors: *Waste treatment, *Coliforms, Salmonella, *Sewage bacteria, *Periphyton, *Municipal wastes, *Enteric bacteria, *Missouri River, *Sewage treatment, Waste water treatment, Taste, Viruses, Indicators.
Identifiers: Fish Flesh Tainting.

The involvement of the Federal Government in achieving municipal waste treatment on the lower 800 mile reach of the Missouri River is summarized. Included in the narrative are descriptions of unique field investigations involving the use of fecal sterols as a pollution indicator, the isolation of enteric virus, and the measurement of fish flesh tainting potential and periphyton communities as related to waste outfalls. In addition, intensive bacteriological investigations of densities of the fecal coliform group, fecal streptococci and salmonella are discussed. Complete documentation of all known water quality investigations is contained in the appendix. The report provides comprehensive technical support for a policy of secondard treatment for waste discharges into the Missouri River. (Walter-EPA)
W71-13821

GRANDVIEW LAKE SEWAGE RESEARCH AND DEMONSTRATION PROJECT,
SIECO, Inc., Columbus, Ind.
S. M. Rees, and G. F. Hendricks.
Annual Report. 1971, 34 p.

Descriptors: *Sewers, *Waste water treatment, *Pumps, Septic tanks, Disposal, Hydraulic systems, Lagoons, Water reuse, Irrigation water.
Identifiers: *Pump-grinders, *Pressure sewers.

A pressure-sewer system is designed to provide satisfactory waste treatment and disposal for a small community located on a recreational resource where conventional waste collection and treatment by individual home systems are not feasible. The system employs small plastic piping, individual home pump-grinders and lagoon treatment of the collected wastewaters, with effluent disposal by irrigation. Descriptions of problems encountered in design, construction and operation, along with some cost breakdowns, are presented. (Kreissl-EPA)
W71-13822

FILTRATION KINETICS IN WATER AND WASTEWATER,
California Univ., Berkeley.
M. C. Kavanaugh, A. N. Wright, G. Toregas, L. Hallen, and E. A. Pearson.
Second annual progress report, August 1971. 54 p, 10 tab, 14 fig, 18 ref.

Descriptors: *Filtration, *Model studies, Equations, Filters, Zeta potential, Ion transport, *Pilot plants, Optimization, Suspension, Granules, Particle size.
Identifiers: *Variable analysis.

The modes of particle deposition in a deep-bed filter are presented. The capacity of the filter for retaining particles removed from suspensions is reported for particles of different degrees of stabilization. The transition of filter performance from clogging to breakthrough conditions is found to be controlled by the ratio of particle size to the mean grain size and particle flux. Ranges of applicability of different forms of solids removal, including filtration, are noted. Ionic strength and zeta potential are purported to be influential in terms of filter response. The optimum use of filtration is said to require control of both particle stability and particle size distribution. (Kreissl-EPA)
W71-13823

WASTEWATER REUSE,
National Water Commission, Arlington, Va.
Jerome Gavis.
Available from National Technical Information Service as PB-201 535, $3.00 paper copy, $0.95 microfiche. Report NWC-EES-71-003, July 1971. 161 p, 7 tab, 126 ref.

Descriptors: Water reuse, Water source, *Tertiary treatment, *Waste water treatment, *Water utilization, Sewage disposal, Sewage treatment, Waste treatment, Water resources, *Water supply, Waterworks, Water quality, Water pollution, Water conservation, Industrial water, Water costs, Water reclamation, Municipal water, *Reviews.

The report evaluates the potential for wastewater reuse through reclamation of effluents from advanced wastewater treatment plants. Brief descriptions and references indicate the extent of such

practice at the present time and likely possibilities for future developments. Emphasis is on the resource value of wastewater. Potential for reclamation of used municipal and industrial water are discussed in terms of direct reuse (recirculating) and indirect reuse (effluent from upstream use mixes with streamflow and is withdrawn downstream). Advanced treatment technology is described by processes for the removal of constituents in the effluents, with cost data and a review of major problems. Comparison with desalination and interbasin transfer costs is suggested. Need for research in evaluation and control of virological hazards is stressed. Relationship of advanced treatment processes to secondary treatment processes is included. An optimistic view is presented for the growth of the practice of water reuse, concluding that it will continue with growth of population and industry in the United States. (Fuhrman-National Water Commission)
W71-13871

INDUSTRIAL WATER SUPPLY FROM PROCESSED SEWAGE TREATMENT PLANT EFFLUENT AT BALTIMORE, MARYLAND,
A. Wolman.
In: Water, Health and Society, Indiana University Press. 1969, p 74-83. 1 tab.

Descriptors: *Industrial water, *Water supply, *Sewage treatment, *Sewage effluents, Chlorides, Effluents, *Water reuse, Maryland.
Identifiers: *Baltimore, *Bethlehem Steel Company, *Back River (Md), Sewer system.

The Bethlehem Steel Company of Sparrows Point, Maryland was confronted with finding new sources of water for industrial use in making steel, with a minimum safe yield of approximately 50 m.g.d., when its underground water source began to deplete (1941). The Company decided to develop a water supply with the treated effluent of the Back River Sewage Treatment Works of Baltimore City. It had a continuing yield of 90 and 100 m.g.d., and was sufficiently economical to be processed and delivered for industrial uses. The Bethlehem Steel Company agreed to be responsible for financing all costs attendant upon processing, pumping, delivering, and distributing the effluents from the Back River plant, while Baltimore City agreed to make these effluents available. The Steel Company built, maintains, and operates the whole works necessary for use of this supply. Its capital expenditures will be somewhat over two million dollars. One of the major difficulties encountered in the system was the chloride content of the sewage. A detailed survey was made by the company on the problem of chlorine content in the water, the first such study of a municipal sewer system (in the opinion of the author). It was ascertained that high concentrations of chlorine almost invariably occurred in the low-level collection and interception system providing service to industrial and commercial areas of the city. Some of these sources have been eliminated. (Strachan-Chicago)
W71-13886

PHYSICAL AND CHEMICAL PROCESSES FOR NITROGEN REMOVAL--THEORY AND APPLICATION,
Stanford Univ., Calif.
George Tchobanoglous.
Available from Engineering Publications Office, 112 Engineering Hall, University of Illinois, Urbana 61801 - Price $4.50. In: Proceedings 12th Sanitary Engineering Conference on Nitrate and Water Supply: Sources and Control, February 11-12, 1970, University of Illinois, Urbana: Illinois University, College of Engineering Publication, p 110-135, 1970. 26 p, 14 fig, 5 gab, 37 ref.

Descriptors: *Waste water treatment, *Nitrogen compounds, *Nitrates, Ion exchange, Chlorination, Activated carbon, Ammonia, Adsorption, Sewage treatment, Water pollution treatment, Water pollution control.
Identifiers: *Nitrogen removal.

The various physical and chemical processes which are available for removing nitrogen compounds are reviewed. Ammonia nitrogen can be removed by air stripping, ion exchange and chlorination. Air stripping has received much attention recently, but some operational problems still exist. Ion exchange is quite costly, while chlorination is applicable for solutions with low ammonia concentrations. Organic nitrogen can be removed by adsorption on activated carbon, adsorption on ion exchange resins, and by passage through soil. Nitrate nitrogen can be removed by ion exchange and chemical reduction. Cost estimates for these processes are also presented. (Knapp-USGS)
W71-13938

BIOLOGICAL PROCESSES FOR NITROGEN REMOVAL--THEORY AND APPLICATION,
Stanford Univ., Calif.
Perry L. McCarty.
Available from Engineering Publications Office, 112 Engineering Hall, University of Illinois 61801 - Price $4.50. In: Proceedings 12th Sanitary Engineering Conference on Nitrate and Water Supply: Source and Control, February 11-12, 1970, University of Illinois, Urbana: Illinois University, College of Engineering Publication, p 136-152, 1970. 17 p, 3 fig, 29 ref.

Descriptors: *Waste water treatment, *Nitrification, *Denitrification, *Nitrates, Nitrogen compounds, Ammonia, Algae, Sewage treatment, Tertiary treatment, Water pollution control, Biodegradation.
Identifiers: *Nitrogen removal.

Nitrogen can be removed biologically from waste water by three different processes: bacterial assimilation, algae harvesting, and nitrification-denitrification. Bacterial nitrification-denitrification is perhaps the most promising of the processes. Ammonia nitrogen removal is the result of two stages. In nitrification, ammonia-nitrogen is converted to nitrate-nitrogen by two different groups of autotrophic nitrifying bacteria. Denitrification is the reduction of nitrates and nitrites to nitrogen gas by a wide variety of facultative bacteria under anaerobic conditions. An additional organic source is necessary for efficient conversion to nitrogen gas, and methanol appears to be the least expensive. In general for agricultural and domestic waste water, costs for nitrogen removal may range from 2 to 10 cents per 1,000 gallons. Of the three processes considered, nitrification-denitrification is perhaps the most generally applicable because of good reliability, suitability to a variety of conditions, low area requirements and moderate cost. (Knapp-USGS)
W71-13939

RADIATION TREATMENT OF INDUSTRIAL WASTE WATERS: AN ECONOMIC ANALYSIS,
New York Interstate Sanitation Commission, N.Y.
A. I. Mytelka.
Isotopes and Radiation Technology, Vol 8, No 4, p 444-449, Summer, 1971. 4 fig, 3 tab, 6 ref.

Descriptors: *Waste water treatment, *Industrial wastes, *Gamma rays, *Economic feasibility, *Biodegradation, *Pre-treatment (Water), *Radiation, Cobalt radioisotopes, Design criteria, Total costs.
Identifiers: *Ionizing-radiation, *Chlorantine Fast Red, Oxidation-reaction, Cobalt-60.

The economic feasibility of using radiation as a pretreatment method for increasing the biodegradibility of industrial wastes prior to their discharge into industrial or municipal biological waste-treatment plants is investigated. The method used was to assume an acceptable range of treatment costs (based on the cost of process water) and then to design and estimate the cost of a plant to provide treatment at these costs (based on the cost of the energy source, cobalt-60, and actual plant design). A reaction rate that would allow the use of radiation treatment to meet each cost was then calculated. Finally, the calculated reaction rate was compared to that obtained in the laboratory. The two wastes treated were 2-Napthalene sulfonic acid sodium salt and Chlorantine Fast Red. Depending on the waste considered and the allowable treatment costs, overall oxidation-reaction efficiencies presently obtainable must be increased by factors varying from 2 to 25 before radiation treatment will be economically feasible. This will necessitate a major breakthrough and indicates a need for further work on understanding the basic chemistry involved. (Haugh-Wisconsin)
W71-13951

SANITARIANS AND WATER AND WASTEWATER TREATMENT FACILITY OPERATORS.
For primary bibliographic entry see Field 06E.
W71-13954

REDUCTION AND ESTERIFICATION OF CHOLESTEROL AND SITOSTEROL BY HOMOGENATES OF FECES,
Montefiore Hospital, Bronx, N.Y.
R. S. Rosenfeld, and L. Hellman.
Journal of Lipid Research, Vol 12, No 2, 1971, p 192-197. 4 tab, 23 ref.

Descriptors: *Lipid, Microorganisms, *Waste treatment, Incubation, Aluminum compound, Waste water treatment, Acids.
Identifiers: *Cholesterol, *Sitosterol, *Feces, Free sterols, Bile acid, Estification.

Mixtures of cholesterol-1,2-3H and sitosterol 4-14C have been incubated with suspensions of feces in order to compare the behavior of the phytosterol with transformations known to take place with cholesterol under these conditions. Within the limitations of the study both labeled sterols were esterified to the same extent, and reduction of the delta 5 double bond to the saturated analogue proceeded equally in both substances. After correcting for procedural losses, the recoveries of 3H and 14C from the incubations were always less than the controls; this strongly indicates destruction of sterol by feces microorganisms. (Bundy-Iowa State)
W71-13986

TYPES OF MANURE DRYERS.

Poultry Digest, p 338-340, July 1971.

Descriptors: *Poultry, *Farm wastes, *Drying, Capital investment, Moisture content, Dehydration, *Waste treatment.
Identifiers: Rotary dryers, Conveyor dryers, Vibrating conveyor dryers, Vibrating type conveyor, Three pass drum, 2 stage drying.

With the increase in demand for poultry manure drying, several dryers operating on different principles have been put on the market. One type of dryer subjects manure to 1400 degrees of temperature in a rotating drum. Another type dryer uses the conveyor principle. The conveyor-type unit pulls the manure back and forth through a unit with air temperatures of 400 to 600 degrees. A modified version of the conveyor type vibrates. This is a new type expected to be on the market during the summer of 1971. The temperature ranges from 1000 degrees at the start and drops to 400 degrees. A three-pass drum method of drying utilizes hot gas temperatures up to 1800 degrees, and allows 75 feet of horizontal travel in a 25 foot drum. A two stage drying method is being promoted which will reduce the drying cost. The first stage uses mechanical stirrers on the manure aided by a high velocity air current. This first stage reduces the moisture without applying heat to the manure. While the second stage process drys the manure down to the desired moisture content. The two stage process allows more manure to be dryed or allows for a smaller dryer. (Bundy-Iowa State)
W71-13988

TRY TO KEEP ODORS UNDER CONTROL,
J. L. Skinner.
Poultry Digest, March 1971. p 116.

Descriptors: *Odor, Farm wastes, Poultry, Livestock, Management, Disposal, Public rights, *Waste treatment.
Identifiers: *Odor control, Public relations.

Four suggestions are given for managing conditions related to odor problems: (1) Reduce spillage and overflow from watering systems. (2) Make sure that manure removal systems actually remove manure and do not leave unnecessary accumulations in corners, adjacent to winch and drive mechanisms, and around discharge elevators. (3) Use only manure transport vehicles that do not spill or leak on roadways. (4) Avoid field spreading manure near residences, close to roads, late in the afternoon of still days or on weekends. (Hazen-Iowa)
W71-13989

WHY STIRRING MANURE REDUCES ODORS,
Pennsylvania State Univ., State College. International Poultry Industries Exposition.
Glenn O. Bressler.
Poultry Digest, p 60, February 1971.

Descriptors: *Anaerobic condition, *Air circulation, *Aeration, Anaerobic condition, Odors, Bacterial, Drying, Gases, Velocity, Movement, Air pollution, *Farm wastes, *Waste treatment.
Identifiers: Sewerage gas, Anaerobic bacteria.

Anaerobic bacterial action is the primary cause of the offensive odors in manure. High velocity air circulating over the droppings hinders the bacterial action and reduces the odor. However, the high velocity air movement over the manure does not stop the bacterial action underneath the surface. To rid the odor producing gases from forming, the anaerobic bacteria must be destroyed. By aerating with fans and stirring several times daily, most of the anaerobic bacteria are destroyed. This combined operation destroys the odor as well as increases the speed of drying the droplets. (Bundy-Iowa State)
W71-13990

WATER TECHNOLOGY II,
Nuclear Utilities Services, Pittsburgh, Pa. C. W. Rice Div.
For primary bibliographic entry see Field 03A.
W71-13994

INVESTIGATION OF A PROCESS FOR REMOVAL OF COPPER FROM SEA WATER DESALINATION PLANT EFFLUENT USING CARBON SORBATES,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
For primary bibliographic entry see Field 03A.
W71-13999

5E. Ultimate Disposal of Wastes

MARINE TOILETS.
For primary bibliographic entry see Field 06E.
W71-13128

REGULATIONS AND REQUIREMENTS (DISCHARGE OF WASTES).
Virginia State Water Control Board, Richmond.
For primary bibliographic entry see Field 06E.
W71-13196

SUPERVISION OF OIL, GAS, AND NATURAL DRY GAS WELLS.
For primary bibliographic entry see Field 06E.
W71-13214

LIQUID INDUSTRIAL WASTES.
For primary bibliographic entry see Field 06E.
W71-13222

COMPARATIVE EVALUATION OF BIOLOGICAL TYPE FOOD PROCESSING LIQUID WASTE DISPOSAL SYSTEMS,
Maryland Univ., College Park. Dept. of Horticulture.
For primary bibliographic entry see Field 05D.
W71-13308

THE DESIGN AND OPERATION OF A PRIVATE WASTE DISPOSAL PLANT NEAR SARNIA, ONTARIO,
Trecan Ltd., Cooksville (Ontario).
For primary bibliographic entry see Field 05D.
W71-13412

ENVIRONMENT AND THE QUALITY OF LIFE,
For primary bibliographic entry see Field 06E.
W71-13416

STUDIES ON DENSIFICATION OF COAL MINE DRAINAGE SLUDGE,
Bituminous Coal Research, Inc., Monroeville, Pa.
For primary bibliographic entry see Field 05D.
W71-13515

LEWIS V. CITY OF POTOSI (DAMAGE TO RIPARIAN FROM MUNICIPAL SEWAGE DISPOSAL).
For primary bibliographic entry see Field 06E.
W71-13529

ULTIMATE DISPOSAL OF PHOSPHATE FROM WASTEWATER BY RECOVERY AS FERTILIZER,
Grace (W.R.) and Co., Lake Zurich, Ill. Dearborn Chemical Div.
For primary bibliographic entry see Field 05D.
W71-13557

DISPOSAL OF LIQUID AND PARTICULATE WASTES TO THE OCEAN,
Federal Water Pollution Control Administration, Corvallis, Oreg. Pacific Northwest Water Lab.
For primary bibliographic entry see Field 05D.
W71-13558

THE ECONOMICS OF SEWAGE DISPOSAL IN A COASTAL URBAN AREA-A CASE STUDY OF THE MONTEREY PENINSULA, CALIFORNIA,
California Univ., Berkely. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 05G.
W71-13605

WASTE DISCHARGE REPORTS AND REQUIREMENTS.
Califrnia State Water Resources Control Board, Sacramento.
For primary bibliographic entry see Field 05G.
W71-13677

DISPOSAL OF INDUSTRIAL WASTES.
For primary bibliographic entry see Field 06E.
W71-13679

STANDARDS OF QUALITY FOR PUBLIC WATERS OF OREGON AND DISPOSAL THEREIN OF SEWAGE AND INDUSTRIAL WASTES.
For primary bibliographic entry see Field 05G.
W71-13685

WASTE DISPOSAL.
For primary bibliographic entry see Field 05G.
W71-13693

EVALUATING WASTE DISPOSAL AT SEA -- THE CRITICAL ROLE OF INFORMATION MANAGEMENT,
Bisset-Berman Corp., San Diego, Calif.
R. P. Brown, and E. H. Shenton.
In: Marine Technology Society 7th Annual Conference, August 16-18, 1971, Washington, D.C., p. 353-362. 1 fig, 2 tab, 10 ref.

Descriptors: *Waste disposal, *Monitoring, *Inspection, *Pollution abatement, Legislation, Systems, Pacific Coast region.
Identifiers: *Ocean dumping, *Information management, Regulatory surveillance, Environmental monitoring, Toxic material disposal.

An evaluation is presented of a 1971 re-survey of present and projected U.S. ocean dumping activities in terms of proposed Congressional legislation. A drastic reduction in ocean dumping volume has occurred along the Pacific Coast. Anticipated termination of the dumping of toxic materials and other wastes will significantly change the national status of dumping activities. The results of the study show that although adequate information on the subject is available, the latest projections for funding future regulatory surveillance and environmental monitoring of dumping operations are based on 1968 data which do not describe the current situation. (Currer-PAI)
W71-13726

COASTAL ZONE WASTE DISPOSAL -- AN OVERVIEW,
Stanford Research Inst., Irvine, Calif.
C. G. Gunnerson.
In: Marine Technology Society 7th Annual Conference, August 16-18, 1971, Washington, D.C., p 501-502.

Descriptors: *Solid wastes, *Sea water, *Federal Government, Federal jurisdiction, Ultimate disposal, Waste disposal.
Identifiers: *Federal Council on Environmental Quality, Policy recommendations, Coastal zone waste disposal.

In October, 1970, the Federal Council on Environmental Quality took note of the solid wastes being disposed at sea and made a number of policy recommendations which are summarized. (Currer-PAI)
W71-13734

CONTAINER DUMPING IN THE NORTH SEA,
United Nations Educational, Scientific and Cultural Organization, Paris (France). Intergovernmental Oceanographic Commission.
For primary bibliographic entry see Field 05B.
W71-13748

METHODS FOR DISPOSAL OF POULTRY MANURE,
New Zealand Dept. of Agriculture, Christchurch.
For primary bibliographic entry see Field 05D.
W71-13792

SUBSURFACE WASTE DISPOSAL BY MEANS OF WELLS--A SELECTIVE ANNOTATED BIBLIOGRAPHY,
Geological Survey, Washington, D.C.
D. R. Rima, E. B. Chase, and B. M. Myers.
Available from the Sup Doc GPO Wash, D.C. 20402-$1.50. geological Survey Water-Supply Paper 2020, 1971. 305 p, 692 ref.

Descriptors: *Injection wells, *Injection, waste water disposal, *Industrial wastes, *Brine disposal, *Radioactive waste disposal, *Bibliographies, Waste disposal, Wastes, United States, Foreign countries, Groundwater movement, Hydrodynamics, Hydrogeology, Documentation, Geochemistry, Rock properties, Fluid mechanics.

Identifiers: *Waste migration, *Subsurface waste storage, *Fluid waste, *Environmental effects.

This bibliography of 692 selective references on waste disposal through wells is intended as a source document for both scientific and waste-management needs. It was stimulated by the increasing number of injection wells being used by industry since Congress passed the CleanStreams Act of 1966, which restricts discharge of waste into surface waters; and by the need for pertinent information on the environmental effect of waste injection, particularly the exotic and complex components of some industrial wastes. The bibliography brings together abstracts with citations that pertain to (1) the injection technology of the oil industry in collecting, handling, treating, and injecting waste waters into the subsurface; (2) research studies on the disposal of radioactive wastes that emphasize the interaction of radioactive materials with the natural environment, and thus have direct application to the problems of predicting and monitoring the post-injection movement of waste waters; and (3) case histories of various industries that are using injection wells. The bibliography is arranged alphabetically by author and has separate geographic (United States and foreign) and subject indexes. (Lang-USGS)
W71-13909

5F. Water Treatment and Quality Alteration

VIRUS REMOVAL BY CHEMICAL COAGULATION,

Tennessee Univ., Knoxville.
For primary bibliographic entry see Field 05D.
W71-13146

WATERWORKS AND SEWAGE DISPOSAL.

For primary bibliographic entry see Field 06E.
W71-13177

EUTROPHICATION IN RELATION TO WATER SUPPLIES,

Bolton Inst. of Tech. (England)
E. G. Bellinger.
Journal of the Society for Water Treatment and Examination, Vol 19, Part 4, p 400-409, 1970. 1 fig, 3 tab, 21 ref, discussion.

Descriptors: *Eutrophication, *Water supply, Water pollution effects, Nutrients, Reservoir operation, Water reuse, Potable water, Algae, Nutrient requirements, Cyanophyta, Chlamydomonas.
Identifiers: *United Kingdom, Esthwaite Water (England), Lake Windermere (England), Great Ouse (England), Algal growth.

The greasteot increases in eutrophication have taken place in Britian since 1910 and are correlated with population growth. Dissolved solids and phosphate concentrations have also increased significantly coupled with biological productivity—with algae the main offenders. Removal of nutrients by various sewage treatment processes would not be low enough to prevent algal growth, but sufficiently low to slow down artificial eutrophication. The effects of eutrophication and consequent diatom growths and blue-green algae cause problems in waterworks and unpleasant olfactory responses to potable water as well as anaerobic conditions deleterious to water supplies. Reservoir management should provide at the outlet tower for a number of abstraction points at different depths to permit use of the best quality water available. Control of the thermocline level by pumping, thus increasing the depth of the epilimnion, would provide a greater depth of better quality water. Inasmuch as algae is light dependent, plastic sheeting to exclude light and increasing turbidity by pumping and jetting would reduce light penetration. It seems certain that more and more wastewaters will have to be reused and that wastewater should be considered as an integral part of the nation's resources. (Jones-Wisconsin)
W71-13185

CHLORINATION OF ODORANTS FROM ALGAL BLOOMS,

Technion - Israel Inst. of Tech., Haifa. Sanitary Engineering Lab.
M. Rebhun, M. A. Fox, and J. B. Sless.
Journal American Water Works Association, Vol 63, No 4, p 219-224, 1971. 8 fig, 7 tab, 17 ref.

Descriptors: *Water quality, *Chlorination, *Water quality control, *Odor, Algae, Eutrophication, Taste, Reservoirs, Seasonal, Actinomycetes, Cyanophyta, Plankton, On-site tests, Laboratory tests.
Identifiers: *Israel, *Lake Kinneret (Israel), Peridinium westi, Oscillatoria prolifica, Threshold odor number.

The water supplies distributed by Israel's National Water Carrier frequently develop taste and odor problems. A study was conducted to determine the relationships between the planktonic alga Peridinium westi and the benthonic alga Oscillatoria to isolate the characterize the odorants and to determine whether a quantitative relationship exists between odor and chlorination levels. Field tests evaluated interrelationships between algal numbers and species composition, and threshold odor number and chlorine demand. Odorants produced by Peridinium and Oscillatoria were concentrated and collected for characterization and quantitative analysis of effect of chlorination on threshold odor number in the laboratory. Fluctuations in levels of algal numbers, chlorine demand, and threshold odor number of reservoir water were seasonal and interrelated. Chlorine demand was exerted by substances in solution and not by algal cells at normal concentrations. Odor control caused by Peridinum was dependent on proper chlorination of free residual. Earthly odors caused by Oscillatoria could not be completely removed by chlorination; the level of odor reduction was linearly dependent on initial odor level. A method of collecting odorants from laboratory cultures of aquatic organisms was developed. (Jones-Wisconsin)
W71-13187

EVALUATION OF THE HYPOIODOUS IODINE TABLET,

Naval Medical Field Research Lab., Camp Lejeune, N.C.
Ned S. Hurst and P. L. Schwartz.
Available from the National Technical Information Service as AD-723 561, $3.00 in paper copy, $0.95 in microfiche. volume 21, No 7, April 1971. 11 p, 4 tab, 4 ref. MF12.524.007-8007Bx8I.10.

Descriptors: *Water purification, *Pesticides, Bactericides, Taste, Preservation, Aging (Physical), Solubility, *Water treatment, Potable water.
Identifiers: *Iodine compounds, Survival kits.

The feasibility was investigated of utilizing hypoiodous acid tablets (HOI) as an agent for microbial decontamination of water. Results are presented of studies of the palatability, disinfectant capability and iodine content of the HOI tablets stored at 4C, ambient conditions, and 29C with a relative humidity of approximately 85%. Tablets stored at 29C with a relative humidity of approximately 85% turned yellowish-green, and the time required for a tablet to dissolve was increased. Storage conditions influenced the iodine content, coloration and solubility of the HOI tablets.
W71-13372

REPORT ON OPERATIONS CONTROL CENTER FOR THE WATER UTILITY DEPARTMENT OF THE CITY OF DALLAS, TEXAS.

Black and Veatch Consulting Engineers, Kansas City, Mo.

February 20, 1969. 80 p, 3 fig, 1 tab.

Descriptors: *Automation, *Automatic control, *Remote control, *Electronic equipment, *Supervisory control, Data transmission, Telemetry, Control systems, Mechanical control, Model studies, Distribution systems, Monitoring, Digital computers, Treatment facilities, Pumping plants, Instrumentation, Texas.
Identifiers: *Dallas, Operations control center.

Improvements were studied in the operation of the water supply and distribution system and the waste water system of Dallas. Suggestions are presented for expanding the existing telemetering system and the few existing supervisory control systems to establish a Central Operations Control Center. Supervisory control and data handling equipment is recommended for adaption at the earliest possible date to a control system employing a digital computer. The estimated cost of supervisory control and electrical equipment, together with valves and piping is approximately two million dollars. Additional costs would be involved if sewage treatment plants, lift stations and pumping stations are tied into the Operations Control Center. More efficient operation of the water distribution system and the development of improved and expanded data handling and processing appear to be the principal reasons for the recommendations. Operating costs can be reduced by converting attended pumping stations to an unattended status. (Poertner)
W71-13567

WATER CUSTOMERS, CRITERIA, AND COSTS,

American Water Works Association, Garden City, N.Y.
R. J. Faust.
In: Proceedings of the Eleventh Sanitary Engineering Conference, February 5-6, 1969, Urbana, Illinois, Illinois Dept of Public Health and University of Illinois, Urbana, Dept of Civil Engineering, p 1-8, 1 tab, 3 ref.

Descriptors: *Water costs, *Water supply, *Standards, *Water pollution, *Water quality, Public health.
Identifiers: History of water standards, U. S. Public Health Service.

The demand for clean, safe water has a long history of battles fought to convince the public and city officials of the values of financial support to meet the standards of quality water. The low standards of the early nineteenth century have evolved to the U. S. Public Health Service's 'Drinking Water Standards' which serve as the minimum for all public water supplies. While adequate for public health, these standards say little about such criteria as taste, turbidity, color, radiological standards, corroveness, and hardness. To remedy this the American Water Works Association has approved 'Quality Goals for Potable Water.' The cost of meeting these goals is still a great factor which varies with the chemical constituents of the current supply and the pollution control of the raw water source and is estimated at from 0 to 20 cents per month per person over a 20-year period. (Wade-Wisconsin)
W71-13650

FLUORINE AND THE PUBLIC WATER SUPPLY,

A. Wolman.
In: Water, Health and Society, Indiana University Press. 1969, p 69-73. 11 ref.

Descriptors: *Fluorine, *Water, *Water treatment, *Water supply, Public health, Epidemiology.
Identifiers: *Fluorination, *Dental care, Public water.

Fluorination of water prevents certain dental caries in certain age groups. However, an excess of fluoride in the water causes chronic dental fluorosis, i.e., mottled enamel. The water purveyor must decide whether he is running a serious risk of causing damage when he uses the public water supply to introduce fluoride (in amounts of 1.0 or more parts per million) to bring beneficial results to a few age

groups. This article suggests some considerations in this area of discussion. 1. The water supply officer must remain open and responsive to evidence from the professional health officer, physician, and dentist. 2. The addition of fluoride to the public water supply is wasteful since all the water is treated, but only about 10% of the water is ingested. 3. There are problems of control of dosage. 4. While fluoride is helpful to some age groups, there is not sufficient evidence that it is not harmful to other age groups. The article suggests that epidemiological studies are needed to prove the safety of low flourination as it relates to other aspects of community health. (Strachan-Chicago)
W71-13885

CONCEPTS OF POLICY IN THE FORMULATION OF SO-CALLED STANDARDS OF HEALTH AND SOCIETY,
A. Wolman.
In: Water, Health and Society, Indiana University Press, 1969, p 123-129. 1 ref.

Descriptors: *Public health, *Safety, Formulation, *Decision making, *Planning, *Standards, *Radiation, Safety factors, Water pollution control.
Identifiers: Policy making, *Radiation control.

The evolution of radiation standards is discussed in reference to the standardization of public health and safety standards. Brief generalizations are made in reference to two questions posed by the staff of the Joint Congressional Committee on Atomic Energy. 1. What have been the typical practices in public health in developing protection criteria, with particular reference to benefits, risks, and costs in the broadest social and economic sense. 2. How do common arguments applied to radiation hazard appear if applied to historically more familiar hazards. The two questions deal with the evolution of standards in the fields of health and safety, other than standards pertaining specifically to radiation control. The lessons of the past in general health and safety practices are characterized by continual revisions, by consistently giving the public the benefit of the doubt, by an ever narrowing gap between knowledge and application, by qualitative assessments of hazard, and by objectives calling for the elimination of fatalities due to disease. The radiation field is confronted with the same decisions and problems which have already confronted the field of public health, while at the same time, being greatly complicated by the biologic effects which must be considered. The author maintains that the day of 'handbook rule' for measuring the hazard of radiation is a long way off. Consequently, one must necessarily act with limited knowledge and the guiding principle must be the maximum protection of people. (Strachan-Chicago)
W71-13887

CHANGING PUBLIC HEALTH PRACTICES AND PROBLEMS,
A. Wolman.
In: Water, Health and Society, Indiana University Press. 1969, p 305-315. 1 tab.

Descriptors: *Public health, *Planning, *Investigations, *Maintenance, *Future planning (Projected), *Governments, Federal government, State governments, Local governments, Minnesota, Massachusetts, Maryland.
Identifiers: *Public health programs, *Future public health programs, *Allocation, Voluntary associations.

The future of public health programs is discussed in terms of investigations in this area made by various local governments (Minnesota, Massachusetts, and Maryland), by the Federal government, and by voluntary associations. Seven general statements are made. The author suggests that these statements be considered in future planning of health programs. (1) The field of public health is expanding beyond concern solely with communicable diseases and community sanitation. (2) The more familiar public health programs must be continued. (3) Causes of death have changed and they demand new techniques, a wider base, more money, and more concern. (4) The maintenance of mental and physical health should be awarded more concern. (5) Facilities for hospitalization and medical care of all kinds should be increased. (6) More trained personnel are needed. (7) More money will be needed for these programs, resulting in increased intrusion by State and Federal governments into the field of local health. (Strachan-Chicago)
W71-13890

MINERAL TASTE AND THE POTABILITY OF DOMESTIC WATER,
California Univ., Berkeley.
W. H. Bruvold.
Water Research, Vol 4, p 331-340, November 1969. 2 fig, 10 tab, 10 ref.

Descriptors: *Domestic water, *Potable water, *Taste, Water quality, Water quality control, Standards, California.
Identifiers: *Mineral taste, Taste quality, Mineral content.

The relation between mineral content and the general taste quality of water is described. Consumers from 11 selected California communities evaluated the taste of the local water by completing specially constructed attitude scales. Taste panel members evaluated the taste of the same 11 waters using specially constructed rating scales. Total mineral content in the water ranged from 50 to 2250 mg/l. Results from both consumer and panel work showed an inverse linear relation between taste quality and total mineral content. The implications of these results for establishing standards limiting mineral content in domestic water were discussed. (Strachan-Chicago)
W71-13892

SANITARIANS AND WATER AND WASTEWATER TREATMENT FACILITY OPERATORS.
For primary bibliographic entry see Field 06E.
W71-13954

5G. Water Quality Control

LITTER CONTROL ACT.
For primary bibliographic entry see Field 06E.
W71-13134

WATERCRAFT POLLUTION CONTROL ACT OF 1970.
For primary bibliographic entry see Field 06E.
W71-13148

WATER RESOURCES COMMISSION.
For primary bibliographic entry see Field 06E.
W71-13155

THE LAND AND WATER CONSERVATION AND RECLAMATION ACT.
For primary bibliographic entry see Field 06E.
W71-13160

WATERWORKS AND SEWAGE DISPOSAL.
For primary bibliographic entry see Field 06E.
W71-13177

CHLORINATION OF ODORANTS FROM ALGAL BLOOMS,
Technion - Israel Inst. of Tech., Haifa. Sanitary Engineering Lab.
For primary bibliographic entry see Field 05F.
W71-13187

THE ECONOMICS OF CLEAN WATER.
Senate, Washington, D.C. Committee on Public Works.

Summary Report, U.S. Department of the Interior, Federal Water Pollution Control Administration, 91st Cong, 2d Sess, March 1970. 20 p, 2 fig, 16 tab.

Descriptors: *Federal government, *Treatment facilities, *Water pollution control, *Investment, Water quality control, Government finance, Estimated costs, Water pollution, Pollution abatement, Financing, Financial feasibility, Economic impact, Economic prediction, Financial analysis, Municipal wastes, Industrial wastes, Waste treatment, Water pollution treatment, Standards, State governments, Legal aspects, Annual costs, Captial costs.

In order to analyze the overall magnitude and geographical and financial dimensions of water pollution abatement programs, this summary report represents current estimates of the investment levels necessary to attain applicable water quality standards. The report defines the rate of investment that will close the gap for municipal and industrial waste treatment within a five-year period, given the continued pertinence of present regulatory and technological conditions. The report examines the following subsidiary issues: (1) the influence of location on unit investment, (2) the status of broadly integrated regional waste-handling systems, (3) the incidence of recapitalization, (4) the influence of price levels on investment, and (5) the changing patterns in the adjusted costs of waste treatment facilities. Although the overall level of investment is rising steadily, the investment of $880 million in 1969 did little more than cover replacement and growth needs developed in the same year. With the expected growth of municipal waste-handling systems and continuing inflation at present levels, total investment requirements will conservatively amount to $10 billion over the next five years if all existing deficiencies are to be remedied and no new deficiencies are allowed to occur. (Smiljanich-Florida)
W71-13192

OIL POLLUTION LIABILITY AND FINANCIAL RESPONSIBILITY.
Senate, Washington, D.C. Committee on Public Works.

A Report to the President and to the Congress from the Secretary of Transportation, April 1971. 20 p.

Descriptors: *Federal government, *Remedies, *Damages, *Water pollution sources, Administrative decisions, Water pollution control, Oil, Legislation, Administrative agencies, Legal aspects, Water law, Water pollution, Water policy, Ships, Transportation, Oil industry, Drilling, Oil wastes, Oil wells, Oily water, Federal jurisdiction, Insurance, Water quality, Water quality control.

Pursuant to the Federal Water Pollution Control Act, this study evaluates and makes recommendations concerning the financial responsibility of vessels and facilities in relation to the cost of removing discharged oil and the payment of resulting damages. Limitation of liability for vessels should not now be changed, but drilling vessels should be governed by the limits applicable to offshore facilities. Preemptive federal jurisdiction in this area is needed. No changes in liability limitations for onshore and offshore facilities are now needed. The Administrator of the Environmental Protection Agency should prescribe proof of financial loss requirements that reflect the relative pollution potential of a facility. Insurance coverage is available, and the scope of private funds is expanding, but new avenues must be explored for assuring the coverage of smaller facilities. The recovery of damages should be based on strict liability. If recovery is barred by statutory limitation, compensation should be made from a damage fund. The third party defense to strict liability should be precluded where a contract exists between the owner and a third party. (Robinson-Florida)
W71-13193

WATER POLLUTION CONTROL LEGISLATION--PART I.
Senate, Washington, D.C. Subcommittee on Air and Water Pollution.

Hearings, U.S. Senate, 92d Cong, 1st Sess, March 15, 16, 17, 18, 19, 22, 23, 24, 1971, part 1. 598 p, 20 fig, 29 tab, 6 chart, 26 ref, 3 append.

Descriptors: *Water pollution control, *Federal government, *Pollution abatement, *Legislation, Water pollution, Water pollution treatment, Financing, Government finance, Administrative agencies, Administrative decisions, Administration, Detergents, Standards, Water quality, Water quality control, Lakes, River basins, State governments, Waste water treatment, Industrial wastes, Pesticides, Legal aspects.

Fifteen bills either amending the Federal Water Pollution Control Act or presenting other proposed legislation relating to water pollution control are considered in these hearings. Bills offered by Senator Muskie and the Administration present alternative proposals for the more efficient enforcement of water quality standards under the Federal Water Pollution Control Act. Other bills discussed herein: (1) regulate pollution from detergents, (2) control marine pollution, (3) establish a national lake areas system, (4) regulate pesticides, (5) provide manufacturing standards for certain products, (6) provide financial assistance for river-basin programs, (7) provide a higher penalty for violations of the Refuse Act, (8) prevent the deceptive advertising of products to control pollution, (9) amend the appropriations provision of the Federal Water Pollution Control Act, (10) provide financial assistance for the construction of waste treatment facilities, (11) establish an Environment Financing Authority, and (12) provide for lake pollution abatement. Extensive testimony, comparisons of present and proposed legislation, letters, and articles are contained in the report. (Hart-Florida)
W71-13194

WATER RESOURCE MANAGEMENT IN THE UPPER POTOMAC BASIN.
Interstate Commission on the Potomac River Basin, Harrisonburg, Va.

Interstate Commission on the Potomac River Basin, Annual Fall Public Meeting, Harrisonburg, Virginia, Nov. 5-6, 1970. 130 p, 3 tab.

Descriptors: *River basin commissions, *Water resources development, *Water quality control, *Water pollution control, Interstate rivers, Watersheds (Basins), Standards, Maryland, Waste disposal, Waste water treatment, Sediment control, Mine drainage, Virginia, Municipal wastes, Industrial wastes, Farm wastes, West Virginia, Legislation, Administration, Pennsylvania, Grants, Treatment facilities, Federal government, State governments.
Identifiers: *Upper Potomac River Basin, *Potomac River.

The progress of the water quality management programs within the Potomac River Basin is outlined in this report. The Federal Water Quality Administration's programs concerning waste treatment plants, regional planning, and stream monitoring are detailed. Recent Maryland legislation has given rise to: (1) a county comprehensive water, sewerage, and solid wastes plan; (2) municipal sewage plant grants; (3) an operator's training and certification program; and (4) new powers for the Department of Water Resources. The Pennsylvania Clean Streams Act was amended to provide for: (1) upgraded water quality and pollution control programs and powers, and (2) new water quality standards for interstate rivers. Virginia has promulgated new water quality standards and established a non-degradation policy, a regional-planning program, and a fish-kill policy. New Virginia legislation has created a mandatory certification program for the operators of water and waste water works, an operators' training program, and a construction-grant program for treatment facilities. The progress of West Virginia is presented in terms of specific streams and their pollution problems and domestic and industrial waste treatment. Acid mine drainage is also discussed. The report concludes with several topical papers on such topics as erosion and sediment control and water resources planning. (Rees-Florida)
W71-13195

REGULATIONS AND REQUIREMENTS (DISCHARGE OF WASTES).
Virginia State Water Control Board, Richmond.
For primary bibliographic entry see Field 06E.
W71-13196

ELEMENTS OF LIABILITY.
American Law Inst.
For primary bibliographic entry see Field 06E.
W71-13197

SEWAGE AND INDUSTRIAL WASTE TREATMENT REQUIREMENTS AND EFFLUENT CRITERIA.
Illinois Dept. of Public Health, Springfield. Sanitary Water Board.
For primary bibliographic entry see Field 06E.
W71-13198

MERCURY REGULATIONS.
Illinois Pollution Control Board, Springfield.
For primary bibliographic entry see Field 06E.
W71-13199

WATER QUALITY STANDARDS: INTRASTATE WATERS EXCLUSIVE OF INTERSTATE WATERS.
Illinois Sanitary Water Board, Springfield.

Rules and Regulations SWB-14, March, 1968. 8 p, 1 map.

Descriptors: *Illinois, *Standards, *Water quality control, *Regulation, Pollution abatement, Governments, State jurisdiction, Administrative agencies, Water pollution, Water quality, Legal aspects, Waste treatment, Waste disposal, Wastes, Waste water disposal, Public health, Permits, Adoption of practices, Administrative decisions, Water utilization.

The policy of Illinois is to maintain reasonable standards of purity for the waters of the state consistent with their use for domestic and industrial water supplies; the propagation of wildlife, fish and aquatic life; and for domestic, agricultural, industrial, recreational, and other legitimate uses. The discharge of any waste is prohibited unless such waste has been treated to prevent the pollution of receiving waters. The water quality standards herein prescribed are deemed necessary to safeguard waters for designated public purposes. Violation of these standards shall be considered an indication that polluted condition exists and will, therefore, be subject to abatement. Specific water quality criteria are established for the following public uses: (1) public water supply and food processing; (2) aquatic life sectors; (3) recreation sectors; and (4) agriculture or stock watering. Minimum criteria applicable to all waters are set forth. An explicit implementation and enforcement plan is herein detailed. (Horwitz-Florida)
W71-13200

POLLUTION: AN INTERNATIONAL PROBLEM NEEDING INTERNATIONAL SOLUTION,
Supreme Court, Washington, D.C.
W. O. Douglas.
Texas International Law Journal, Vol 7, No 1, p 1-3, Summer 1971. 3 p.

Descriptors: *Water pollution control, *Estuaries, *Pollution abatement, *International law, International waters, Water pollution sources, International commissions, Estuarine environment, Oceans, Aquatic habitats, Foreign countries, Governments, Jurisdiction, Water pollution, Thermal pollution, Oil, Dredging, Pesticides, DDT, Sewage effluents, Industry, Legislation, Legal aspects, United Nations, Non-structural alternatives.

The biosphere is unitary despite our jurisdictional entities. Pollution controls must therefore be international. Estuaries, upon which most marine life are dependant during some part of their cycle, are being destroyed by dredge and fill operations, creating irretrievable damage. Pesticides are also creating water pollution problems, along with thermal pollution, oil spillages, and sewage effluents. The largest contributors to ocean pollution, as well as to air pollution, are the industrialized nations, which are increasing in number. International controls should take effect through United Nations Conventions and some degree of federalism. Canada's Artic Waters Prevention Act may be suggestive of the law the world needs to safeguard estuaries and oceans from the almost certain degradation they face under present pressures. (Smiljanich-Florida)
W71-13201

REPORT ON THE FRAMEWORK STUDY.
Nebraska Soil and Water Conservation Commission, Lincoln.
For primary bibliographic entry see Field 06E.
W71-13202

UNILATERAL AND MULTILATERAL APPROACHES TO ENVIRONMENTAL PROBLEMS,
J. B. Yates.
University of Toronto Law Journal, Vol 21, No 2, p 182-192, 1971. 11 p, 43 ref.

Descriptors: *Water pollution control, *International law, *International waters, *Oil industry, Oil, International commissions, Water pollution, Water pollution effects, Water pollution sources, Water quality, Oceans, Foreign waters, Law of the sea, Foreign countries, Governments, Disasters, Accidents, Legal aspects, Regime, Non-structural alternatives, Environmental sanitation.

Despite current concern over pollution and the environmental crisis, it is obvious that little is known about pollution and its ultimate effects. When sufficient scientific and technical knowledge is available, jurists will have the task of providing legal safeguards from pollution. In providing these safeguards, a crucial distinction must be made between pollution resulting from disasters and accumulated pollution. Little difficulty is encountered in obtaining compensation for pollution disasters. For example, the International Maritime Consultative Organization has agreed upon strict, but limited, liability for disasters such as the Torrey Canyon. Ecological deterioration of the biosphere, however, is more difficult to control. No comprehensive program to prevent gradual accumulations of harmful substances in the oceans has been developed. A high degree of resource management is necessary to achieve this type of pollution control. Some pollution situations are best handled nationally, while for others a multilateral approach is best. An international anti-pollution agency might handle these multilateral actions. Furthermore, since consumers must ultimately bear the costs of pollution compensation through higher prices, a form of enterprise liability should be developed. (Hart-Florida)
W71-13203

INTERNATIONAL LAW AND POLLUTION OF INTERNATIONAL RIVERS AND LAKES,
C. B. Bourne.
University of Toronto Law Journal, Vol 21, No 2, p 193-202, 1971. 10 p, 22 ref.

Descriptors: *International law, *International commissions, *Pollution abatement, *International waters, Foreign countries, Foreign waters, Water treatment, Water pollution control, Water pollution sources, Water pollution, Water quality, Water quality control, Legal aspects, Judicial decisions, Non-structural alternatives.

Although a considerable controversy exists over the available quantity of clean water, there is actually no shortage of fresh water on earth. The real problem is providing high quality water at a reasonable cost. The law governing water quality in international rivers and lakes is generally the doctrine of equitable utilization. This doctrine has international support under the Helsinki Rules of 1966. Under the equitable utilization principle, each basin state is entitled to a reasonable and equitable share in the beneficial uses of water in an international drainage basin. Thus, the doctrine utilizes a reasonable man test. A state is liable for altering water quality only if substantial injury results and the polluting use is not within its reasonable and equitable share of beneficial water use. A state must only take reasonable measure to abate existing pollution. To date, adjudication has been unsuccessful in resolving conflicts over the pollution of international waters. Cooperative studies, conferences, and commissions such as the United States-Canada International Joint Commission might more readily resolve international water quality conflicts. Basins must be managed on an individual basis, however, because pollution abatement objectives may not apply to several basins.
W71-13204

THE FREEDOM OF THE SEAS: A LICENSE TO POLLUTE,
L. H. J. Legault.
University of Toronto Law Journal, Vol 21, No 2, p 211-221 (1971). 11 p.

Descriptors: *International law, *International waters, *Water pollution control, *Law of the sea, Foreign countries, Ships, Oceans, Coasts, Oil, Oil industry, Pollutants, Water pollution sources, Water pollution effects, Admiralty, Governments, Non-structural alternatives.
Identifiers: *International conferences.

Man has begun to realize that the oceans cannot be indiscriminately used as a dumping ground. The existing law of the sea, however, inhibits marine pollution control. On the high seas only the flag state has jurisdiction over a vessel. Coastal states have only limited jurisdiction over vessels in their territorial waters. International conventions have attempted to control marine pollution. The 1954 London convention prohibited intentional discharges of oil within 50 miles of land. In 1962, the International Maritime Consultative Organization (IMCO) extended the prohibition to 100 miles. Nevertheless, effective enforcement procedures were not established. A 1970 IMCO conference strengthened pollution control by permitting coastal states to take reasonable action to prevent the pollution of their shores. Moreover, the 1967 Brussels conference imposed strict, but limited, liability for oil discharges by vessels. From the Canadian viewpoint, both conventions are inadequate because they are restricted to oil discharges and are only remedial. Effective measures are needed to control marine pollution. These measures must embody the principles that reasonable extra-territorial action may be taken for environmental protection, and that the passage of a vessel which threatens the environment is not innocent under international law. (Hart-Florida)
W71-13205

INTERNATIONAL CONVENTION FOR THE PREVENTION OF POLLUTION OF THE SEA BY OIL, 1954, BETWEEN THE UNITED STATES OF AMERICA AND OTHER GOVERNMENTS.

In: Treaties and Other International Agreements on Oceanographic Resources, Fisheries, and Wildlife to which the United States is a Party, Senate Committee on Commerce, 91st Congress, 2d Session, Committee Print, December 1970, p 92-121. 30 p, 3 append.

Descriptors: *Treaties, *Oil, *Water pollution, *Ships, International law, Water pollution sources, Pollution abatement, Pollutants, International waters, Oily water, Oil wastes, Oceans, Sea water, Waste disposal, Waste dumps, Waste water (Pollution), Disposal, Foreign countries, United States, Legislation, Harbors, Legal aspects, Adjudication procedure.

In order to prevent sea pollution by oil discharged from ships, this international convention was ratified by the United States, and is set forth herein, with amendments and reservations. Subject to certain exceptions, discharge of oil from any tanker within specified prohibited zones shall be unlawful. Any discharge of oily ballast water or tank washings from any ship not a tanker shall be made as far as practicable from land. Oil discharge from such a ship shall not be prohibited when the ship is proceeding to a port not providing reception facilities. Penalties for unlawful discharges shall be commensurate with those which would have been imposed if the discharge had been into territorial waters. Ships registered by the contracting governments shall be equipped to prevent the escape of oil, and major ports shall possess receptacles for oily residues from bilges. Each ship shall maintain an oil record book containing daily information of ship's activities. Procedures for review of disagreements or interpretations are prescribed, as well as procedure for enactment of amendments. Appendixes include descriptions of the prohibited zones, forms for the oil record books, and various subsequent amendments to the Convention. (Smiljanich-Florida)
W71-13206

AMENDMENTS TO THE INTERNATIONAL CONVENTION FOR THE PREVENTION OF THE POLLUTION OF THE SEA BY OIL.
In: Treaties and Other International Agreements on Oceanographic Resources, Fisheries, and Wildlife to which the United States is a Party, Senate Committee on Commerce, 91st Congress, 2d Session, Committee Print, December 1970, p 582-590. 9 p, append.

Descriptors: *Treaties, *Oil, *Water pollution, *Ships, Water pollution sources, Pollution abatement, Pollutants, International law, International waters, Discharge measurement, Oily water, Oceans, Sea water, Oil wastes, Disposal, Foreign countries, Waste disposal, United States, Waste water (Pollution), Waste dumps, Legislation, Legal aspects, Aquatic environment.

Certain amendments to the International Convention for the Prevention of the Pollution of the Sea by Oil are herein set forth. Discharge from a non-tanker shall be permitted only when: (1) the ship is proceeding en route, (2) the instantaneous rate of discharge of oil content does not exceed specified rates, (3) the oil content of the discharge is under a specified maximum limit, and (4) the discharge is made as far as practicable from land. Oil discharges from tankers shall be permitted only when: (1) the above conditions are met, (2) the oil discharged does not exceed a specified percentage of cargo-carrying capacity, and (3) the tanker is more than 50 miles from land. Ships shall be so fitted as to prevent, as far as reasonable and practicable, the escape of oil into bilges not containing oily-water separators. Activities which must be included in oil record books are amended, along with the form for such books. An international conference on marine pollution shall convene in 1973 for the purpose of preparing a suitable international agreement for placing restraints on the contamination of the sea, land, and air by ships and equipment operating in the marine environment. (Smiljanich-Florida)
W71-13207

FINAL ACT OF THE INTERNATIONAL LEGAL CONFERENCE ON MARINE POLLUTION DAMAGE.
In: Treaties and Other International Agreements on Oceanographic Resources, Fisheries, and Wildlife to which the United States is a Party, Senate Committee on Commerce, 91st Congress, 2d Session, Committee Print, December 1970, p 591-593. 3 p.

Descriptors: *International law, *Water pollution, *Damages, *Organizations, International waters, United Nations, Foreign governments, Administrative agencies, Pollution abatement, Aquatic environment, Oceans, Legal aspects, Treaties, Oil, Water pollution sources, Water pollution control.

In this report of the Final Act of the International Legal conference on Marine Pollution Damage, details are given of the decision by the Inter-Governmental Maritime Consultative Organization to convene an international conference to consider the adoption of conventions on questions relating to marine pollution damage. The governments represented are listed, along with various United Nations agencies and non-governmental organizations present at the conference. Officers elected and committees established are also listed. Draft articles of proposed conventions were considered. As a result of the deliberations the conference prepared and opened for signature two conventions: (1) the International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, and (2) the International Convention on Civil Liability for Oil Pollution Damage. (Smiljanich-Florida)
W71-13208

INTERNATIONAL CONVENTION RELATING TO INTERVENTION ON THE HIGH SEAS IN CASES OF OIL POLLUTION CASUALTIES.
In: Treaties and Other International Agreements on Oceanographic Resources, Fisheries, and Wildlife to which the United States is a Party, Senate Committee on Commerce, 91st Congress, 2d Session, Committee Print, December 1970, p 594-603. 10 p, append.

Descriptors: *Treaties, *Pollution abatement, *Water pollution, *Oil, Disasters, Water pollution sources, Water pollution control, Abatement, Foreign countries, International waters, International law, Oily water, Waste dumps, Disposal, Ships, Damages, Accidents, Compensation, Legislation, Negotiations, Aquatic environment, Legal aspects, Adjudication procedure.

To provide measures of an exceptional character to protect against the grave consequences of maritime casualties resulting in sea and coastal oil pollution, the International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties is herein adopted. Governments may take necessary measures on the high seas to prevent grave and imminent danger to their coasts from oil pollution resulting from a casualty. No measures, however, may be taken against warships or other state-owned ships in non-commercial service. Procedures in taking abatement measures include: (1) consultation with other states affected, and with the flag state of the concerned vessel; (2) notification to those affected by the measures taken; (3) in cases of extreme emergency, the taking of immediate action without prior consultation and notification; and (4) the avoidance of any risk to human life. Measures taken shall be proportionate to the actual or threatened damage. Damages caused by measures not reasonably necessary shall be compensated. Procedures for negotiation of disagreements, ratification, amendment, and termination are set forth. In an annex, procedures to be followed where negotiations fail include the use of conciliation commissions and arbitration. (Smiljanich-Florida)
W71-13209

INTERNATIONAL CONVENTION ON CIVIL LIABILITY FOR OIL POLLUTION DAMAGE.
In: Treaties and Other International Agreements on Oceanographic Resources, Fisheries, and Wildlife to which the United States is a Party, Senate Committee on Commerce, 91st Congress, 2d Session, Committee Print, December 1970, p 604-614. 11 p, append.

Descriptors: *Treaties, *Oil, *Water pollution, *Damages, International law, Compensation, Pollution abatement, Water pollution sources, Water pollution control, Pollutants, Oily water, Oil industry, International waters, Oceans, Coasts, Foreign countries, Legislation, Legal aspects, Ships, Disposal, Accidents, Adjudication procedure.

To insure that adequate compensation is available to persons suffering oil pollution damage from ships, the International Convention on Civil Liability for Oil Pollution Damage is herein set forth. The Convention shall apply exclusively to pollution damage occurring on the territory and territorial sea of a contracting state, and to preventive measures taken to prevent or minimize such damage. With certain exceptions, the owner of the responsible ship shall be liable for any oil pollution damage. Two or more ships causing oil pollution damage shall be jointly and severally liable for all damage not reasonably severable. Liability limits based on ship tonnage are specified, along with the procedures for depositing funds to insure liability payments. Mandatory insurance for such damages is required for ships exceeding a specified tonnage. Actions for compensation must be brought within three years of the incident. Adjudication shall be in courts of the affected state, whose judgment shall be recognized by the other contracting governments. Procedures for ratification and amendment are included. Resolutions annexed to the Convention include a request for establishment of an international compensation fund, and recommendations of international cooperation concerning non-oil pollutants. (Smiljanich-Florida)
W71-13210

SUPERVISION OF OIL, GAS, AND NATURAL DRY GAS WELLS.
For primary bibliographic entry see Field 06E.
W71-13214

LIQUID INDUSTRIAL WASTES.
For primary bibliographic entry see Field 06E.
W71-13222

SEWAGE DISPOSAL AND WATER SUPPLY.
For primary bibliographic entry see Field 06E.
W71-13223

POLLUTION CHARGES INCOME AND THE COSTS OF WATER QUALITY MANAGEMENT,
Ohio State Univ., Columbus. Dept. of Economics.
J. H. Boyd.
Water Resources Research, Vol 7, No 4, p 759-769, August 1971. 3 fig, 2 tab, 20 ref.

Descriptors: *Optimum development plans, *Computer model, *Economic efficiency, *Pollutants, *Water quality control, *Low flow augmentation, Marginal costs, Unit costs, Waste assimilative capacity.
Identifiers: *Pareto, Lange-Lerner, Potomac Estuary, Lehigh reservoirs, Miami River.

This paper presented an economic model to optimize the value of a river's pollutant disposal and water quality services. Various studies were reviewed and a hypothetical case was considered in which the relationship between pollution charges income and capacity augmentation costs when there is one upstream polluter and one downstream quality beneficiary was examined. The net revenue equation was illustrated with several examples. A section on low flow augmentation provided empirical evidence on the relationships between pollution, water quality, and low flow augmentation and on the storage-yield and storage cost relationships. Final evidence showed that the revenues from marginal opportunity cost pollutant disposal fees would exceed the costs of an optimal level of flow augmentation. (Markell-Cornell)
W71-13227

WATER POLLUTION.
For primary bibliographic entry see Field 06E.
W71-13239

DIVISION OF MINERAL RESOURCES.
For primary bibliographic entry see Field 06E.
W71-13240

WATER POLLUTION.
For primary bibliographic entry see Field 06E.
W71-13259

A RIVER AS A CHEMICAL REACTOR,
Maine Univ., Orono.
E. G. Bobalek, W. E. Daniels, L. S. Dennis, J. L. Heck, and J. L. Liu, et al.
Available from NTIS As PB-203 594-Vol I, PB-203 595 Vol II, PB-203 596 Vol III, $3.00 in paper copy, $0.95 in microfiche. Maine University Research Project Final Report, 3 volumes July 1971. 992 p. OWRR B-005-ME (1).

Descriptors: *Water quality control, *River, *Water pollution control, *Estuaries, *Model studies, Water chemistry, Chemical reactions, River regulation, Warning systems, Monitoring, Remote sensing, Telemetry, Hydrologic cycle, Self-purification, Ecology, Data collections, Saline water, Maine.
Identifiers: *Penobscot estuary (Maine).

This report covers four years of research on the control of the water quality in a tidal estuary (Penobscot, Maine). Volume 1 of the report contains a brief outline of the work performed and the results. The pertinent technical details are contained in the appendices. Volumes II and III contain copies of theses and publications prepared during the course of the project. Rivers and estuaries are viewed as giant chemical reactors within which certain classes of input materials are processed to form certain other materials. The system developed was based on the assumption that there exists a single measurable attribute that is indicative of the river water quality. It is also assumed that there is a minimum (or maximum) value of this attribute beyond which it is undesirable to go. Further, it is assumed that there is a causative relationship between the amount of material being introduced into the river and the down stream water quality. When these conditions exist, it is technically possible to maintain a river at or above a designated minimum quality. The control of the water quality in a river depends not only on technical factors, bur on economic, sociological, and political factors as well. (See also W71-13273 thru W71-13284) (Woodard-USGS)
W71-13272

A DIGITAL COMPUTER TECHNIQUE FOR THE OPTIMAL CONTROL OF POLLUTANTS IN A CASCADED INPUT ESTUARY,
Maine Univ., Orono.
J. L. Heck.
In: A River As A Chemical Reactor, Volume 2, Maine University Research Project Final Report, p 184-250, July 1971. 5 fig, 5 ref, 4 append. OWRR B-005-ME (1).

Descriptors: *Water quality control, *Estuaries, *Model studies, *Data collections, *Water pollution control, Computer models, Tides, Water chemistry, Chemical reactions, Self-purification, Monitoring, Telemetry, Methodology, Systems analysis, Saline water, Maine.

A computer control system capable of controlling the water quality in an estuary being polluted by several cascaded inputs is described. A feedforward control system was used, in conjunction with a mathematical model of the estuary, to predict the optimal effluent flowrate at each point with respect to a specified index of performance. This index of performance was (1) that the oxygen sag point be equal to the critical dissolved oxygen content, (2) that the effluent flowrates at each input point be related to each other in a specified equitable manner. The desired solution is optimal with respect to these criteria. The technique used to implement the control functions give the system a wide applicability. The mathematical model upon which control predictions are made was developed as a modular unit of the computer control system to facilitate model variations and to insure independence of the system. (See also W71-13272) (Woodard-USGS)
W71-13273

THE HARMONIC ANALYSIS OF THE PENOBSCOT RIVER TIDES,
Maine Univ., Orono.
L. Dennis.
In: A River As A Chemical Reactor, Volume 2, Maine University Research Project Final Report, p 110-183, July 1971. 5 fig, 9 chart, 12 ref. OWRR B-005-ME (1).

Descriptors: *Estuaries, *Tidal waters, *Water circulation, *Water pollution control, *Model studies, Water quality, Mathematical models, Equations, Forecasting, Analytical techniques, Data collections, Hydrologic data, Water chemistry, Water quality control, Maine.

The tidal characteristics of the Penobscot River are analyzed. Knowing the movement of large amounts of water in the river is important in predicting pollution processes in a model study of the estuary. Tidal data were collected at three sites: Winterport, Hampden, and Brewer. These testing stations consist of pressure-sensitive devices permanently situated beneath the water at such a level that when low tide occurs, the device will still be submerged in water. This device provides a continuous record of the water level accurate to 2.4 inches. The harmonic analysis of the tidal movements was made by reducing the observed tide into seven harmonic constituents, and thereby predicting the tides for any point in time. When the prediction equation was compared with the observed tide, the times of high tide differed by less than thirty minutes, and the amplitudes differed, at all points, by less than 2.3 feet. (See also W71-13272) (Woodard-USGS)
W71-13274

THE DETERMINATION OF THE RATES OF DIFFUSION OF DISSOLVED OXYGEN IN SALINE WATERS,
Maine Univ., Orono.
J. L. Liu.
In: A River As A Chemical Reactor, Volume 2, Maine University Research Project Final Report, p 252-298, July 1971. 6 fig, 6 tab, 24 ref, 3 append. OWRR B-005-ME (1).

Descriptors: *Water quality control, *Water pollution control, *Dissolved oxygen, *Diffusion, *Saline water, Laboratory tests, Analytical techniques, Salinity, Water quality, Estuaries, Water analysis, Water chemistry, Maine.
Identifiers: Diffusion rates.

The diffusion of dissolved oxygen is studied under isothermal conditions from concentrations of 7.2 to 8.4 ppm dissolved oxygen in different concentrations of saline solutions and distilled water. The diffusion was studied in an apparatus without any separating device as a diaphragm. The equipment was constructed of polyvinyl-dichloride pipe with septum covered sampling ports. Provision was made for separating the solutions with a ball valve until a diffusion experiment was started. The micro scale Winkler method of oxygen determination was used for analysis of the oxygen accumulation in the

oxygen depleted solution. Experiments were generally continued for 8 to 10 hours, however some were extended to 28 to 30 hours. The major finding of the study was that the rate of diffusion of dissolved oxygen is slow and is the controlling factor in the restoration of oxygen to oxygen depleted waters. The specific rates at the end of 1/2 hour of diffusion were: for 'trace contaminated' water 0.24 mg/hr 0.2N and 0.6N sodium chloride solutions 0.16 and 0.164 mg/hr and in distilled water 0.13 mg/hr. The presence of sodium and chloride ions, even in very small amounts contributes to the diffusion of dissolved oxygen. (See also W71-13272) (Woodard-USGS)
W71-13275

DESIGN OF A SYSTEM FOR REMOTE POLLUTION RELATED MEASUREMENTS ON AN ESTUARY,
Maine Univ., Orono.
D. A. Makinen.
In: A River As A Chemical Reactor, Volume 2, Maine University Research Project Final Report, p 301-366, July 1971. 10 fig, 6 tab, 21 ref, 7 append. OWRR B-005-ME (1).

Descriptors: *Water quality control, *Water pollution control, *Estuaries, *Data collections, *Remote sensing, Model studies, Water chemistry, River regulation, Monitoring, Telemetry, Chemical reactions, Self-purification, Methodology, Systems analysis, Saline water, Maine.

Recent investigations at the University of Maine have produced a method of water pollution control based on the natural cleansing properties of a body of water. The control system proposed uses a model of the body of water to predict the effect on the pollution level due to an effluent input. Based on the model's prediction the effluent input is adjusted to maintain a minimum dissolved oxygen level in the water. The system was specified to collect data on the Penobscot River Estuary for the formation of a model in order to implement the control system. The data gathering system consists of five free-floating buoys for measuring dissolved oxygen, salinity and temperature on a sample of water from the river. Measurements are also made on the current speed and direction at the level of the measurement. The parameters are measured at five depths sequentially. An analysis of the expected measurement error was made for analog and digital recording methods. A prototype of the system is under construction and will be used to verify the performance predictions as well as to gather data for formation of a model of the Penobscot Estuary. (See also W71-13272) (Woodard-USGS)
W71-13276

AN EVOLUTIONARY RIVER MODEL VIA ON-LINE SYSTEM IDENTIFICATION,
Maine Univ., Orono.
K. I. Mumme.
In: A River As A Chemical Reactor, Volume 2, Maine University Research Project Final Report, p 367A-458, July 1971. 5 fig, 5 tab, 75 ref, 3 append. OWRR B-005-ME (1).

Descriptors: *Water quality control, *Rivers, *Estuaries, *Model studies, *Water pollution control, Data collections, Water chemistry, Monitoring, Telemetry, Methodology, Self-purification, River regulation, Dissolved oxygen, Biochemical oxygen demand, Saline water, Maine.

A procedure was developed which will optimize the capacity of a river to assimilate BOD as it is discharged into the river by polluters in series along the river. The model was developed for the Penobscot river estuary between Bangor and Bucksport, Maine. A river system, whether it be tidal or freshwater, is in a sense a chemical reactor with inputs, outputs, and operating conditions. If the input is Biological Oxygen Demand (BOD), and the output is Dissolved Oxygen content (DO), then reactor modelling concepts are applicable to the river system. Natural action of the river provides a capacity for assimilation of BOD in the river. By proper manipulation of this capacity, a river can be made to carry away an optimal amount of BOD, consistent with desired water quality, just as a traditional continuous chemical reactor can be made to produce optimally. A relationship between BOD and DO must be provided, and this relationship must adapt to changing reaction conditions in the river. The model provides a self-adaptive system which predict the required relationship to within ten percent of the true relationship. (See also W71-13272) (Woodard-USGS)
W71-13277

AN EVOLUTIONARY RIVER MODEL VIA CONTINUOUS ON-LINE SYSTEM IDENTIFICATION,
Maine Univ., Orono.
K. I. Mumme.
In: A River As A Chemical Reactor, Volume 3, Maine University Research Project Final Report, p 1-28, July 1971. 2 fig, 2 tab, 7 ref. OWRR B-005-ME (1).

Descriptors: *Water quality control, *Rivers, *Estuaries, *Model studies, *Hydrologic data, Mathematical models, Water pollution control, Dissolved oxygen, Biochemical oxygen demand, Self-purification, Water chemistry, Saline water, Maine.

A river can be considered to be a chemical reactor. The dissolved oxygen content of the water can be considered to be either the reactor product (as a representation of water quality) or as an excess reactant to be maximized. In order to control such a reactor, a mathematical model was developed to predict the dissolved oxygen 'response' to a given biological oxygen demand loading or 'input'. The model adapts itself to changing conditions, thereby assuring that the model, at any point in time, provides an acceptably accurate representation of the actual BOD:DO relationship. The modelling system is not peculiar to the river studied, the Penobscot estuary in Maine. It can easily be transferred to other rivers. Actual tests indicate that the model can predict the BOD:DO relationship to within ten percent of the true relationship. (See also W71-13272) (Woodard-USGS)
W71-13278

A STUDY OF A WATER POLLUTION CONTROL SYSTEM TO MAINTAIN THE DISSOLVED OXYGEN STANDARD,
Maine Univ., Orono.
N. C. Pujari.
In: A River As A Chemical Reactor, Volume 3, Maine University Research Project Final Report, p 29-141, July 1971. 35 fig, 8 tab, 25 ref, append. OWRR B-005-ME (1).

Descriptors: *Water quality control, *Rivers, *Estuaries, *Model studies, *Water pollution control, Mathematical models, Hydrologic data, River regulation, Self-purification, Chemical reactions, Water chemistry, Saline water, Maine.

A tubular chemical reactor model of a river or estuary as seen from the pollution control viewpoint is defined mathematically. The term reactor is synonymous with the river. A control system scheme using both feedback and feedforward loops with the model and reactor in an adaptive configuration was developed. All possible parameters and conditions were measured at the reactor inlet. Starting at the reactor inlet, a waste loading is applied at the inlet as a disturbance input to the system. With the system parameters known, the waste loading at the reactor inlet can be regulated in such a fashion that the water quality is maintained at all downstream points. A control system scheme for the regulated discharge of waste into the reactor is described. (See also W71-13272) (Woodard-USGS)
W71-13279

DEVELOPMENT OF A WATER QUALITY CONTROL STRATEGY FOR RIVERS AND ESTUARIES USING HYBRID COMPUTER MODELING TECHNIQUES,
Maine Univ., Orono.
R. H. Poulin.
In: A River As A Chemical Reactor, Volume 3, Maine University Research Project Final Report, p 143-244, July 1971. 37 fig, 4 tab, 24 ref, append. OWRR B-005-ME (1).

Descriptors: *Water quality control, *Rivers, *Estuaries, *Model studies, *Water pollution control, Water chemistry, Computer models, Monitoring, Telemetry, Methodology, Self-purification, River regulation, System analysis, Dissolved oxygen, Biochemical oxygen demand, Saline water, Maine.

A water quality control model for rivers and estuaries using hybrid computer techniques is described. The dissolved oxygen level established by the interplay of reaeration and deoxygenation factors was used as the governing criteria for the control scheme objective. The digital portion of a hybrid computer was used to make preliminary predictions for concentrations of BOD which would guarantee that the oxygen level would remain above a specified minimum. These predictions were verified by use of an analog computer model which simulated estuarine activities. A feedforward control prediction was obtained from the analysis of both the analog and digital computer models. Dissolved oxygen readings taken each hour at a point one mile downstream on the simulated river provide the feedback information required to analyze the accuracy of the river models. As this information became available, the parameters were adjusted in subsequent models to improve their accuracy. (See also W71-13272) (Woodard-USGS)
W71-13280

A SYSTEM FOR REMOTE TELEMETRY OF WATER QUALITY DATA,
Maine Univ., Orono.
W. E. Daniels, and W. W. Turner.
In: A River As A Chemical Reactor, Volume 3, Maine University Research Project Final Report, p 246-250, July 1971. 9 fig, 2 ref. OWRR B-005-ME (1).

Descriptors: *Water quality control, *Water pollution control, *Telemetry, *Salinity, *Dissolved oxygen, Water temperature, Remote sensing, Instrumentation, Analytical techniques, Surface waters, Data collections, Water chemistry, Saline water, Marine.

A system of measuring salinity, temperature and dissolved oxygen at five different depths from a battery operated floating platform and telemetering these data to a computer was designed and built. Water is pumped from each depth in sequence and measurements are made at the surface using a single set of sensors. Each depth is sampled every half hour. Calibrate signals are sent through the system at half hour intervals. Tests indicate an accuracy of 7 percent. The system will operate unattended for three days when powered by lead-acid batteries. (See also W71-13272) (Woodard-USGS)
W71-13281

BUBBLE COALESCENCE AND GAS TRANSFER IN AQUEOUS ELECTROLYTIC SOLUTIONS,
Maine Univ., Orono. Dept. of Chemical Engineering.
R. R. Lessard, and S. A. Zieminski.
In: A River As A Chemical Reactor, Volume 3, Maine University Research Project Final Report, p 251-259a, July 1971. 13 fig, 5 tab, 53 ref. OWRR B-005-ME (1).

Descriptors: *Water pollution control, *Water quality control, *Estuaries, *Diffusion, *Salinity, Investigations, Test procedures, Gases, Electrolysis, Aqueous solutions, Bubbles, Saline water, Marine.

Identifiers: *Gas transfer, *Bubble coalescence.

The effects of inorganic electrolytes on bubble coalescence and interfacial gas transfer in aqueous solution were investigated. The coalescence experiments consisted in contacting a number of pairs of bubbles and evaluating the coalescence percentage as a function of solute concentration. The relationship between them revealed the existence of sharp transition concentrations. These concentrations correlated well with ionic entropy of solution and with the self-diffusion ability of water in solution. These were used as guides in determining a possible mechanism for coalescence which was based on ion-water interactions. The mass-transfer experiments consisted in evaluating, by means of a high-speed photographic technique, the mass-transfer coefficients for the dissolving of acetylene gas from bubbles rising in aqueous solutions. The results demonstrated that some ions decreased the resistance to transfer under the conditions of these experiments. Hydrodynamic considerations and a similarity between resistance and salting-out effects indicated that the phenomenon may also be attributable to ion-water interactions. (See also W71-13272) (Woodard-USGS)
W71-13282

MIXING IN SELF-SUSTAINED TURBULENCE,
Maine Univ., Orono.
D. W. Turner.
In: A River As A Chemical Reactor, Volume 3, Maine University Research Project Final Report, p 260-422, July 1971. 40 fig, 60 tab, 13 ref, 4 append. OWRR B-005-ME (1).

Descriptors: *Water quality control, *Water pollution control, *Mixing, *Estuaries, *Model studies, Diffusion, Turbulence, Analytical techniques, Colorimetry, Tracers, Chemical analysis, Saline water, Marine.

Liquid mixing in a reactor was investigated by using a high energy radiation source which causes a color change in the flowing fluid. The concentration was evaluated by means of a sensitive colorimeter. The chemicals used in the reaction fluid were: Ferric Ammonium Citrate, Ferric Ammonium Oxalate, Ferric Sodium Oxalate, Ferric Oxalate, and Potassium Ferricyanide. The chemicals were individually dissolved in water and mixed under low level incandescent lighting. The concentration fluctuation data and the time lag data obtained showed that the quantity of radial eddy diffusion increased when the Reynolds number of the system was increased. The experimental design of this investigation is new in that the magnitude of the fluctuating quantities are obtained from a time variant response. The experimental design also lends itself to be used for obtaining intensity of radiation of high energy flashtubes, which might be useful in lasar optics. (See also W71-13272) (Woodard-USGS)
W71-13283

BEHAVIOR OF GAS BUBBLES IN AQUEOUS ELECTROLYTE SOLUTIONS,
Maine Univ., Orono.
S. A. Zieminski, and R. C. Whittemore.
In: A River As A Chemical Reactor, Volume 3, Maine University Research Project Final Report, p 424-447, July 1971. 8 fig, 40 ref. OWRR B-005-ME (1).

Descriptors: *Water pollution control, *Aeration, *Estuaries, *Electrolytes, *Saline water, Analytical techniques, Instrumentation, Model studies, Gases, Bubbles, Dispersion, Diffusion, Mass transfer, Coalescence, Aqueous solutions, Maine.

The behavior of gas bubbles was studied by dispersing air bubbles in aqueous electrolyte solutions. The salts used were: NaCl, NaBr, NaI, Na2SO4, Na3PO4, LiCl, MgCl2, MgSO4, CaCl2, AlCl3, and Al2 (SO4)3. The effects of the salts on the interfacial area of dispersion and on the oxygen transfer coefficient were investigated at various salt concentrations. The results showed a definite dependence of the surface area of dispersion on the valence of the ionic species and salt concentrations. A very satisfactory correlation was obtained for all the salts with the use of ionic strength as the correlating parameter. The mechanism of the coalescence-preventing action of the salts is discussed and explained on the basis of ion-water interactions. The oxygen mass transfer coefficient was found to be only slightly dependent on the presence of electrolytes in the range of concentrations used. The importance and possible practical applications of the results are discussed. (See also W71-13272) (Woodard-USGS)
W71-13284

MANAGEMENT OF INDUSTRIAL OIL SPILLS,
Alken-Murray Corp., New York.
T. F. Dalton.
Industrial Water Engineering, Vol 8, No 7, p 28-30, August-September 1971. 3 fig.

Descriptors: *Water pollution treatment, *Water pollution sources, *Water pollution control, *Oily water, *Oil wastes, Methodology, Water, Oil industry.
Identifiers: *Oil spills.

There are numerous methods of removing oil spilled in and around plant operations - from chemicals which will disperse, thicken, or gather the oil, to sinking agents and materials for harvesting the oil. The alternatives available to the plant manager are reviewed. Two recommendations that can be made right away which are imperative in minimizing the consequences of a spill are: (1) Any plant which borders a stream, river, lake, or watershed should have not only an emergency spill plan to follow, but both primary and secondary methods of control; and (2) each oil tank or tank farm should be adequately diked to contain any spill that might occur. The most common method of oil spill recovery is an API separator. This equipment can be a permanent installation or can be field constructed during an emergency. The oil, once it has been retained by the barrier, can be skimmed off manually or with a mechanical skimmer. (Woodard-USGS)
W71-13290

ENGINEERING FEASIBILITY STUDY OF THE BISHOP SYSTEM FOR OPEN OCEAN OIL SPILLS.
Bishop (William R.) and Associates, San Francisco, Calif.

Available from NTIS, Springfield, Va. 22151 as AD 723600 - $3.00 printed copy. Coast Guard Office of Research and Development Report No. 714103/A/006, November 1970. 89 p, 22 fig, 1 tab, 7 dwg, 7 ref, append. Contract DOT-CG-00,266-A.

Descriptors: *Water pollution treatment, *Water pollution sources, *Oily water, *Oil wastes, *Water pollution control, Surface waters, Model studies, Methodology, Oil-water interfaces.
Identifiers: *Oil spills, *Oil spill recovery, Oil skimmer, Bishop system.

Engineering feasibility of the Bishop System for removing all types of oil spills from ocean surface was studied. The system consists of a buoyant apparatus, 21 feet wide, propelled ahead of a support vessel, which closely tracks the sea surface to remove the oil film. Hydraulic pumpimg capacity is 5000 gpm and the system is capable of operating at 4 Knot speed and up to Sea State 4 at reduced speed. Calculated system effectiveness is 240 Barrels per hour for 1/16-inch thick oil film in smooth water at 4.0 Knots. System efficiency is 5% oil to water picked up for a 1/16-inch oil film and 100% for a 1-inch oil film. Cost factors for skimming 1/16-inch oil film in smooth water are estimated at $0.50/Bbl. (Woodard-USGS)
W71-13296

THE EFFECT OF WASTE CONCENTRATION ON VARIABILITY OF THE OXYGEN SAG CURVE IN A POLLUTED STREAM,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
Jerry D. Brammer.
Master's Thesis, December 1970. 60 p, 16 fig, 5 tab, 18 ref.

Descriptors: *Waste assimilative capacity, *Oxygen sag, *Reaeration, Waste water treatment, Oxygenation, Self-purification, Photosynthesis, Dissolved oxygen, Mixing, Turbulence, Temperature, Organic loading, Biochemical oxygen demand, Stochastic processes, Mathematical studies, Average, Sewage, Instrumentation, Calibrations, Water pollution control.
Identifiers: *Poisson distribution, Variance, Glucose.

The stochastic predictive model of stream assimilative capacity uses the parameter delta as a basis for calculating mean BOD or DO values. Unlike earlier methods, this equation gives a probability distribution of BOD or DO at a particular location rather than one definite value of either BOD or DO at one particular time or location. Earlier investigations have established the direct relationship of delta with increasing temperature, and the inverse relationship of delta with increasing turbulence. In order to establish the relationship between delta and BOD load, 5 test runs were made with glucose and settled sewage. Temperature, turbulence, and volume were held constant while organic loading was varied. Results verified that delta increases with increasing BOD concentration. It was also shown that values for delta can be obtained using a Poisson approximation in which the variance of the oxygen deficit, S squared, divided by the mean oxygen deficit, micron, is equal to delta. (Lowry-Texas)
W71-13315

AMORTIZATION OF POLLUTION CONTROL FACILITIES.
Internal Revenue Service, Washington, D.C.
For primary bibliographic entry see Field 06E.
W71-13353

STATE AND LOCAL PRACTICES IN SOLID WASTE MANAGEMENT,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
W71-13362

STORM WATER MANAGEMENT MODEL,
Metcalf and Eddy, Inc., Palo Alto, Calif., and Florida Univ., Gainesville. Dept. of Environmental Engineering; and Water Resources Engineers, Inc., Walnut Creek, Calif.
For primary bibliographic entry see Field 05D.
W71-13370

FLUSHING PATTERN OF NON-REACTIVE EFFLUENTS,
Louisiana State Univ; Baton Rouge. Dept. of Civil Engineering.
A. M. Kamel.
Proceedings Twelfth Coastal Engineering Conference, September 1970, p 1867-1885, Louisiana Water Resources Research Institute Reprint No. 2-71, 19 p, 8 fig, 19 ref.

Descriptors: *Mathematical models, *Time series analysis, Tidal waters, *Model studies, Effluents, Estuaries, Canals, Louisiana, Numerical analysis, Water pollution control.
Identifiers: *Non-reactive effluent, Narrow canals, *Flushing patterns.

In south central Louisiana non-reactive liquid effluents (no decay or absorption of effluent across flow boundaries) are discharged into manmade straight prismatic narrow canals containing

brackish water. A one dimensional numerical model of general application has been developed to study the flushing pattern of liquid effluents discharged into such canals to determine suitable outfalls. The model consists of differential equations of continuity and of motion for one dimentional unsteady flow of homogenous density in a straight, gently sloping, tidal reach which can be solved using an IBM 360/65 digital computer. The generality of the model is obtained by changing the coefficients in the equation to reflect the characteristics of the reach or estuary under study. The model is sensitive to these coefficients and care must be exercised in selecting them. The model has been tested with good results. The flushing pattern depends on the hydraulic conditions and the point of discharge of the effluents. Computational time on an IBM 360/65 digital computer is on the order of 2.5-3.0 minutes. A logical extension of this work is the development of a two dimensional stochastic model for predicting flushing patterns and concentration distributions for larger bodies of water. (Goessling-Texas)
W71-13403

PAYING FOR POLLUTION BY THE POUND.
For primary bibliographic entry see Field 06E.
W71-13415

ENVIRONMENT AND THE QUALITY OF LIFE,
For primary bibliographic entry see Field 06E.
W71-13416

CHEMICAL METHODS FOR NITRIFICATION CONTROL,
Iowa State Univ., Ames.
J. C. Young.
Proceedings, Industrial Waste Conference, 24th, May 6, 7, and 8, 1969, p 1090-1102, 5 fig, 3 tab, 20 ref.

Descriptors: *Biochemical oxygen demand, Measurement, *Nitrification, Neutralization, Water pollution control, *Inhibition, Biological treatment, Acidity.
Identifiers: Pasteurization, Thiourea, Allylthiourea, Methylene blue, *Nitrification control.

Nitrification presents several major problems in the measurement and interpretation of BOD data. A review of the methods of inhibiting nitrification is summarized here along with a critique of these methods. The laboratory results of using 2-chloro-6 (trichloromethyl) pyridine as a nitrification inhibitor are presented. Pasteurization and acidification work satsifactorily but considerable time and a well trained analyst is required for proper results. Some chemicals for nitrification control, methylene blue, ammonium salts, and thiourea, are effective but these all have some limitations which reduce their dependibility. Allylthiourea appears to be effective without significant limitations. 2-chloro-6 (trichloromethyl) pyridine has been tested in the laboratory and at concentrations of 10 mg/l has been found to completely inhibit nitrification in waste water when measuring 20 C BOD by either dilution or respirometeric methods without affecting the carbonaceous oxygen demand. Nitrification control should become a routine practice when measuring BOD. (Goessling-Texas)
W71-13423

MCCOLLUM V. STATE (CRIMINAL LIABILITY OF SUPERVISOR FOR POLLUTION DAMAGE CAUSED BY IMPROPER OPERATIONS OF SUBORDINATES).
For primary bibliographic entry see Field 06E.
W71-13437

INVESTIGATION OF SINKING METHODS FOR REMOVAL OF OIL POLLUTION FROM WATER SURFACES, PHASE 1: SURVEY OF THE STATE-OF-THE-ART,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
B. J. Houston.
Coast Guard Office of Research and Development Report No 704110/A/001-1, February 1971. 55 p, 33 ref, 1 tab, 3 append. 704110. Contract DOT-CG-00, 583-B.

Descriptors: *Water pollution treatment, *Oil wastes, *Oily water, *Reviews, *Water pollution control, Water pollution sources, Surface waters, Oil-water interfaces, Publications.
Identifiers: *Oil spills, *Oil spill recovery, State-of-the-art reviews.

Articles and publications were reviewed to locate and develop information on sinking absorbers for oil spills. Eighteen materials offered by manufacturers were located: one latex treated barite, one treated chalk, five expansive clays, three talcs (treated and untreated), three asbestos materials (treated and untreated), three treated sands, and two treated fly ashes. Based on results of the literature survey and on information supplied by the manufacturers, the 18 materials are assessed and rated with regard to effectiveness in absorbing and sinking oil, effectiveness in retaining oil, availability and cost of the material, hazards to personnel and plant and animal life, and difficulty of application. The most effective sinking absorbers reviewed were the treated asbestos materials which are capable of sinking up to 10 times their weight in oil. (Woodard-USGS)
W71-13452

PESTICIDE CONTROL BOARD.
For primary bibliographic entry see Field 06E.
W71-13511

DOWNFLOW BUBBLE CONTACT AERATION,
New Mexico State Univ., University Park.
Richard E. Speece, Kenneth Needham, and Marcos Madrid.
Journal, Sanitary Engineering Division, Proceedings, of the American Society of Civil Engineers, Vol 97, No. SA 4, August 1971, p 433-441.

Descriptors: *Oxygenation, *Bubbles, *Velocity, Absorption, Air-water interfaces, Saturation, Reaeration, *Aeration, Turbulence, Injection, Carbon dioxide, Nitrogen, Laboratory tests, Oxygen, Dissolved oxygen, Water pollution control.
Identifiers: *Downflow bubble contact aeration, Stripping.

An aeration system capable of 80 to 90% absorption efficiency, when oxygen is injected at a ratio of 0.5% of the water flow rates has been developed. At sea level and 68 deg. F, this downflow bubble contact aeration (DBCA) system, operated at the above performance levels would result in an increase of 5.7 to 6.4 mg/l dissolved oxygen in water passing through. The apparatus consists of an inverted cone into which both air or oxygen and water are injected at the top. Downward velocities at the top of the cone are sufficient to keep forcing the bubbles down, but velocities at the bottom of the cone are not sufficient to allow the bubbles to escape out the bottom. The bubbles are thus kept in suspension, providing much longer contact times than are possible in conventional aeration. Where complete dissolved oxygen saturation is not required and dissolved nitrogen presents no problem, air can be injected at high rates instead of nitrogen. Preliminary indications showed oxygen transfer economy with DBCA and air to be competitive with conventional surface aerators. The system is simple and requires low power input, making it potentially useful in a wide variety of situations. (Lowry-Texas)
W71-13525

PRESENT STATUS OF WATER POLLUTION CONTROL IN JAPAN,
Japan Public Nuisance Lab., Tokyo.
I. Horasawa.
Proceedings, Industrial Waste Conference, 24th, May 6, 7, and 8, 1969. p 939-949, 7 fig, 2 tab.

Descriptors: *Water quality control, *Water utilization, *Water pollution effects, *Legislation, Industrial wastes, Irrigation, Water pollution control.
Identifiers: Cadmium, Mercury.

In Japan, the primary legislation dealing with water pollution control was passed in late 1958. There are four main parts to this act: (1) Appointment of areas to be controlled; (2) Providing water quality standards; (3) Organization of the water pollution control committee; and (4) Reconciliation concerning problems caused by water pollution. The procedure for becoming a water pollution control area requires that the people request it and the prefectural government pass this request to the central government. The central government studies the area and establishes water quality standards. The area then establishes commissions to enforce these standards. Several examples are given in which the water quality was improved by this procedure and in which the water quality was not improved. The pollutional effects are more pronounced in Japan due to the small size of the country, the high population density, the dependence upon water for irrigation and fisheries. There are areas in Japan that are still susceptible to the minimata disease (mercury poisoning) and the ita-ita disease (cadmium poisoning). Special temprary standards have been set for mercury discharges regardless of the area in which the industry is located. Japan has a large potential for water pollution. We hope these procedures and regional waste water treatment plants will help reduce this potential. (Goessling-Texas)
W71-13533

BOARD OF COMMISSIONERS OF LAKE COUNTY V. MENTOR LAGOONS, INC. (PRIVATE LANDOWNERS REMEDIES AGAINST COUNTY COMMISSIONERS MAINTAINING A NUISANCE).
For primary bibliographic entry see Field 06E.
W71-13536

COST OF TREATMENT OF WASTEWATER WITH PARTICULAR REFERENCE TO THE RIVER SYSTEM OF THE TRENT AREA,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 05D.
W71-13542

WATER QUALITY RELATIONSHIPS IN THE RIVER SYSTEM,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 05B.
W71-13543

AKIN AND DIMOCK OIL CO. V. STATE (NEGLIGENCE AND CRIMINAL INTENT ELEMENTS OF STATUTE PROHIBITING POLLUTION).
For primary bibliographic entry see Field 06E.
W71-13546

LOUISIANA COASTAL COMMISSION.
For primary bibliographic entry see Field 06E.
W71-13562

THE ECONOMICS OF SEWAGE DISPOSAL IN A COASTAL URBAN AREA-A CASE STUDY OF THE MONTEREY PENINSULA, CALIFORNIA,
California Univ., Berkely. Dept. of Agricultural Economics.
G. E. Updegraff.
Natural Resources Journal, Vol 11 No 2 P373-389, April 1971.

Descriptors: *Sewage disposal, *Urban sociology, *Decision making, *Economic impact, Water pollution control, Political aspects, Cities, Estuaries,

Bays, Beaches, Recreation, Water quality act, Institutional constraints, Cost-benefit ratio, Methodology, State government, California, Judicial decisions.
Identifiers: Monterey Peninsula (Calif), Coastal urban wastes, Porter-Cologne Act, Judgment problems.

A case study is presented of the water pollution problem of Monterey Peninsula, between Monterey Bay and Carmel Bay, 120 mi south of San Francisco. The bays are noted as recreational attractions for California and out-of-state visitors. Several communities and a few military installations (total population 162,000), and 15,000 visitors each year, discharge nearly all their sewage into the bays; 4% is raw, 49% receives primary treatment, and 47% receives secondary treatment. Problems associated with economics, political procedure, alternative solutions, and decision making are discussed as they fit into the institutional framework. It is concluded that water quality decisions cannot be made by calculation since vital information is lacking and since the decisions include judgment problems, and hence a political decision-making procedure is suggested. Even such a procedure is not entirely adequate. An evaluation is made of the actions of the State under the Porter-Cologne Water Quality Control Act (1970), and the results are summarized. Two changes are suggested with respect to powers and duties of the State under the Act: (1) operationally, pollution should be monitored at the source and (2), the Act should be extended to explicitly encompass the tasks of ranking coastal water areas and to set standards in accordance with this ranking. (Lang-USGS)
W71-13605

WATER POLLUTION IN THE GREATER NEW YORK AREA-SYMPOSIUM.
For primary bibliographic entry see Field 05B.
W71-13624

WATER QUALITY ANALYSIS FOR THE NEW YORK HARBOR COMPLEX,
Manhattan Coll., Bronx, N.Y. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W71-13630

STANOLIND OIL AND GAS CO. V. CARTWRIGHT (DAMAGE TO LAND AND LIVESTOCK BY SURFACE OIL POLLUTION).
For primary bibliographic entry see Field 06E.
W71-13637

APPLICATION OF STATISTICAL DECISION THEORY TO GREAT LAKES MANAGEMENT,
Raytheon Co., Marine Research Lab, New London, Conn.
For primary bibliographic entry see Field 06A.
W71-13654

AN ECONOMIC ANALYSIS OF ORGANIZATIONS OF WATER USERS,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 06B.
W71-13657

WATER POLLUTION CONTROL, RIVER BASIN AUTHORITIES, AND ECONOMIC INCENTIVES: SOME CURRENT POLICY ISSUES,
Resources for the Future, Inc., Washington, D.C.
A. M. Freeman, and R. H. Haveman.
Single copies free on request to RFF; additional copies $0.25 each. Public Policy, Vol 19, No 1, Winter 1971. p 53-74, RFF Reprint No 92, May 1971.

Descriptors: *Federal government, *State governments, *River basins, *Non-structural alternatives, Water pollution control, Resource allocation, Economics, Legal aspects, Water quality control, Planning, Water resources development, Natural resources, Resource development, Water resources, Industrial wastes, Municipal wastes, Water pollution, Administrative agencies, Regional analysis, Institutional constraints.

Congress responded to environmental problems by creating legal and administrative frameworks giving primary control responsibility to the states. The performance record of existing pollution control policy at both the federal and state and local levels has been a failure. Moreover, the existing enforcement-subsidy approach fails to recognize that controlling water use is a basic economic problem of a resource allocation. This failure has stimulated new proposals containing two features which substantially depart from past policy. By emphasizing comprehensive river basin planning and water quality management, the first approach recognizes that a river is a system and cannot be efficiently managed in a piecemeal fashion by numerous agencies and jurisdictions. Secondly, each of the new approaches emphasizes economic incentives--prices and charges--as a means of reducing the output of industrial and municipal wastes. The most prominent proposals and the economic and political issues common to them are evaluated. A proposal for the reform of federal pollution control policy through regional water quality control is set forth. (Gallagher-Florida)
W71-13659

RULES FOR CONFINED FEEDING OPERATIONS WASTE WATER DISPOSAL.
Iowa Water Pollution Control Commission, Des Moines.

1969. 3 p.

Descriptors: *Iowa, *Farm wastes, *Livestock, *Confinement pens, *Water pollution sources, Cattle, Treatment facilities, Water pollution, Waste disposal, Waste water treatment, Water pollution control, Regulation, Permits, State governments, Administrative agencies, Legislation, Legal aspects, Poultry, Organic wastes, Adoption of practices, Waste water disposal.

Confined feeding operations for livestock and poultry in which potential pollution may exist and be subject to regulation are defined as a cattle feedlot or several cattle enclosures on a single property containing at least one hundred cattle and an animal population of greater than one animal for each six hundred square feet. Registration of the operation is required where one or more of the following conditions exist: (1) the number of cattle confined exceeds a thousand head, (2) the feedlot contributes to a watercourse draining a specified acreage of land above the lot, and (3) the runoff water from a feedlot flows into a buried conduit or well. Persons engaged in or intending to initiate livestock operations shall register such operation with the Water Pollution Control Commission. If the State Department of Health determines that an operation does not constitute a water pollution problem, provisions for control facilities will not be required. If an operation is polluting state waters, the operator shall obtain a permit for waste water disposal and shall provide necessary water pollution control facilities. Requirements for such facilities are specified. Such facilities shall be operated so as to prevent water pollution. (Shelnut-Florida)
W71-13660

THE EMERGENT RIGHT TO A DECENT ENVIRONMENT,
National Science Foundation, Washington, D.C.
C. Macchling.
Human Rights, Vol 1, No 1, p 59-73, August 1970. 15 p, 28 ref.

Descriptors: *Water pollution control, *Public rights, *Pollution abatement, *Social aspects, Water pollution, Water quality control, Water pollution sources, Water pollution treatment, Air pollution, Waste disposal, Solid wastes, Public health, Public benefits, Environmental sanitation, Legislation, Judicial decisions, Federal government, Sewage disposal, Municipal wastes, Legal aspects.

Man has long treated his environment as a source of productive resources alone, with little regard for long-term effects on the environment. The gradual degradation of environmental quality has led to the present situation of wide-spread pollution. Water pollution, which poses an immediate threat to human health, has its principal source in municipal and industrial wastes. In the last few years, there has been a sharp increase in governmental activity related to environmental quality, chiefly at the federal level. This has included enactment of an impressive number of federal anti-pollution and conservation measures in the form of both laws and regulations. Recent trends in the law pointing to an emergent right to a decent environment are discussed. The concept of managing the environment has gradually been accepted. New standards of evaluating environmental quality in judicial and administrative proceedings are developing. A burden of responsibility has been placed on proponents of land use and new technology. Traditional concepts of property rights are being challenged by a new array of social and political priorities that place the integrity of the environment over the economic interests of private groups. (Smiljanich-Florida)
W71-13662

THE ALICE-IN-WONDERLAND WORLD OF STANDING,
Biggs, Strayer, Stoel, and Boley, Portland, Oreg.
J. P. Rogers.
Environmental Law, Vol 1, No 2, p 169-177, Spring 1971. 8 p, 35 ref.

Descriptors: *Adjudication procedure, *Jurisdiction, *Water pollution control, *Pollution abatement, Water pollution, Water pollution sources, State jurisdiction, Federal jurisdiction, Judicial decisions, Social aspects, Environmental impact, Public rights, Remedies, Legal aspects, Environment, Administrative agencies, Legislation, Institutions, Public benefits, Water pollution treatment, Institutional constraints.

Recent cases in environmental litigation are analyzed to ascertain the present legal concepts involved in standing to sue for anti-pollution causes. In standing, the question is whether the interest sought to be protected by the complainant is arguably within the zone of interests to be protected or regulated by the statute or constitutional guarantee in question. A plaintiff must in some way be aggrieved in order to sue to protect environmental interests. The possibility of standing for environmental associations is discussed. Such groups have not been afforded an extension of standing in all environmental cases to date. As standing is involved in every environmental law suit, the outcome of this controversy is very important. When pollution of the environment is involved, it is arguable that all citizens are potential plaintiffs. The common ground of recent cases appears to be based on a question of whether there is anyone else to sue for pollution abatement if the particular plaintiff is denied standing. In this way, the power to litigate against pollution is guaranteed to reside in at least some party. (Smiljanich-Florida)
W71-13663

THE RELATIONSHIP BETWEEN FEDERAL AND STATE LAWS TO CONTROL AND PREVENT POLLUTION,
A. Morgenstern.
Environmental Law, Vol 1, No 2, p 238-256, Spring 1971. 19 p, 169 ref.

Descriptors: *Federal-state water rights conflicts, *Pollution abatement, *Water pollution control, *Federal jurisdiction, *State jurisdiction, Jurisdiction, Water pollution, Water pollution treatment, Air pollution, Water quality control, Legislation,

Legal aspects, Federal government, State governments, Local governments, Regulation, Administration, Administrative agencies, Pesticides, Standards, Permits.

Although state involvement has been stressed in past federal anti-pollution legislation, the federal government is assuming a more active stance in recent legislation. A survey is made of recent federal legislation to show new areas of federal involvement and to point out areas where state action has been preempted. The history of water pollution legislation is reviewed. The preference of the federal government for state enforcement has been shown by its reluctance to prosecute violations under older legislation. Courts strive to give states priority in abating pollution. The conflict between state and federal laws must be direct and regulations must have an identical purpose before state law will be preempted. The Control of pesticides, air pollution, radiation, and vehicular emissions are also discussed. Responsibility for pollution abatement, traditionally reserved to the states under the police power, has largely been shifted to the federal government. All levels of government now possess adequate enforcement procedures, but the issue of federal preemption has become a concern in prosecutions for violations of local or state laws. (Smiljanich-Florida)
W71-13664

PUBLIC LAND POLICY AND THE ENVIRONMENT, VOLUME 1, PART 1: THE LEGAL AND ADMINISTRATIVE FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT OF THE PUBLIC LANDS,
Public Land Law Review Commission, Washington, D.C.
For primary bibliographic entry see Field 06E.
W71-13665

POLLUTION--THE RISK AND INSURANCE PROBLEM,
Ebasco Services, Inc, Chicago, Ill.
W. G. Brockmeier.
For the Defense, Vol 12, p 77-80, 1971. 4 p, 13 ref.

Descriptors: *Risks, *Insurance, *Damages, *Water pollution sources, Water pollution, Oil industry, Ships, Legislation, Judicial decisions, Legal aspects, Federal government, Air pollution, Disasters, Compensation, Economics.

The development of pollution insurance with respect to the general liability policy is examined in this article. Pollution is primarily a problem of industrial risk management and not insurance. Prior to 1966 the insurance industry provided coverage only on an accident basis. However, with the advent of the 1966 revised policy, most insurees were placed on an occurrence basis. Recent environmental disasters have resulted in the use of two standard restrictive endorsements. The first is applicable to oil pollution. Coverage is excluded whether or not discharges are sudden and accidental. This exclusion applied only to discharges into watercourses. The second endorsement excludes bodily injury or property damage resulting from the discharge of pollutants upon land, air or water. However, this exclusion does not apply if discharges are sudden and accidental. Due to the impact of the endorsements on the oil industry, oil and tanker companies, for example, formed organizations to provide indemnification for pollution damages. Features of the contamination and pollution exclusion endorsements are described. Recent legislation and litigation are discussed. (Shelnut-Florida)
W71-13666

A POLLUTION SUIT: LAWYER'S GUIDE TO PRIVATE LAW THEORY,
Loyola Univ., Chicago, Ill. School of Law.
For primary bibliographic entry see Field 06E.
W71-13667

INTERNATIONAL ENVIRONMENTAL SCIENCE.
For primary bibliographic entry see Field 06E.
W71-13668

INTERSTATE ENVIRONMENT COMPACT.
Senate, Washington, D.C. Committee on the Judicary.

Hearings on Senate Bill 907--Comm. on the Judiciary--U.S. Senate, 92d Cong, 1st Sess, April 19 and 20, 1971. 144 p, 2 tab, 1 chart.

Descriptors: *Interstate compacts, *Environmental sanitation, *Pollution abatement, *Coordination, State governments, Federal government, Water pollution, Environment, Environmental effects, Administrative agencies, Planning, Water resources development, Governors, Water quality control, Public health, Legal aspects, Non-structural alternatives, Legislation, Evaluation, Jurisdiction.

The environment of every state is affected with local, state, regional, and national interests. Environmental protection, under appropriate arrangements for intergovernmental cooperation, is in the public interest. Since certain pollution problems transcend state boundaries and thereby become common to adjacent states, coordinated and cooperative joint control measures become of common interest. To meet this need, the Interstate Environment Compact has been proposed. It would allow the signatories to: (1) participate in national environmental protection programs, (2) promote inter-governmental cooperation for multistate action through interstate agreements, and (3) encourage cooperative and coordinated environmental protection by the signatories and the federal government. During the hearings, statements evaluating the proposed bill were received from numerous governors and senators, the Intergovernmental Relations Committee, the Southern Governor's Conference, the Environmental Protection Agency, and other independent organizations. (Gallagher-Florida)
W71-13669

CONTEMPORARY STUDIES PROJECT: IMPACT OF LOCAL GOVERNMENTAL UNITS ON WATER QUALITY CONTROL.
Iowa Law Review, Vol. 56, No. 4, p. 804-929 (1971). 126 p, 731 ref.

Descriptors: *Water quality control, *Iowa, *Local governments, *Water pollution control, Water pollution, Water pollution sources, Water pollution treatment, Water quality, State governments, Administration, Administrative agencies, Non-structural alternatives, Pollutants, Pollutant abatement, Cities, City planning, Municipal wastes, Public health, Treatment facilities, Urbanization, Zoning, Eutrophication, Pesticides, Impaired water quality.

The role of local government in Iowa water pollution control is considered in this detailed study. The introduction describes the scope and methodology of the study and Iowa water pollution problems. Municipalities are believed to have significant impact upon water quality; the sources of water pollution in municipal areas and the municipal agencies involved in water quality control are described in detail. The impact of rural government upon water quality is considered. Sources of water pollution in rural areas; county water pollution control efforts, including efforts by county boards of supervisors and health and conservation boards; and water pollution control by such special districts as sanitary, water and soil conservation districts are described. All the statistics concerning present pollution control efforts by local governments are derived from a questionnaire sent to 228 cities, 99 counties, and other agencies. The study concludes that a regional approach is necessary for effective, efficient water pollution control. The study proposes an agency structure and details functions for such an agency. (Hart-Florida)
W71-13670

DOCUMENTS ON THE USE AND CONTROL OF THE WATERS OF INTERSTATE AND INTERNATIONAL STREAMS--COMPACTS, TREATIES, AND ADJUDICATIONS,
House of Representatives, Washington, D.C.
T. R. Wilmer.
House Document No. 319, 90th Cong, 2d Sess, 1968, 815 p. 1 fig, 29 tab, 365 ref.

Descriptors: *Interstate rivers, *Interstate compacts, *Treaties, *Water pollution control, Interstate commissions, Delaware River Basin Commission, River basin commissions, Pollution abatement, Water pollution, Water quality control, Water pollution treatment, Water pollution sources, Waste disposal, Sewage treatment, State governments, Legal aspects, Judicial decisions, Standards, Regulation, Administration, Administrative agencies.

Compiled herein are compacts, treaties, adjudications, and other documents concerning the use and control of the waters of interstate and international streams. These documents indicate the extent to which states may effectively control water pollution and other problems through agreement and cooperation. Such mutual accommodation and agreement should, if possible, be the medium of settlement, rather than judicial determinations. All of the interstate compacts and treaties deal in some way with water pollution control. Among the included interstate compacts dealing primarily with pollution control are: (1) the Delaware River Basin Compact, (2) the Tennessee River Basin Water Pollution Control Compact, (3) the New England Interstate Water Pollution Control Compact, and (4) the New York Harbor (Tri-State) Interstate Sanitation Compact. Reports of interstate litigation involving water pollution control and abatement are also included, and are classified according to the river systems involved. Most compacts create interstate commissions to coordinate pollution control programs. Sewage and waste treatment control provisions in the various compacts attempt to standardize and strengthen waste disposal facilities. Water Quality standards are set for selected interstate streams. (Smiljanich-Florida)
W71-13671

WATER QUALITY STANDARDS (INTERSTATE WATERS, OHIO RIVER AND SALINE RIVER).
Illinois Sanitary Water Board, Springfield.

Rules and Regulations SWB-10, Illinois Sanitary Water Board, Springfield, Illinois, Dec. 1968. 11 p, 1 map, 2 tab.

Descriptors: *Illinois, *Ohio River, *Water quality control, *Standards, Regulation, Pollution abatement, Administrative agencies, Permits, State governments, State jurisdiction, Water pollution, Water quality, Water pollution control, Public health, Water pollution sources, Legal aspects, Waste disposal, Treatment facilities, Project planning, Inspection, Water utilization.

These criteria prescribe the qualities of water which are necessary for the designated public use or benefit. Exceeding stated conditions shall be considered indicative of a polluted condition subject to abatement. These standards are applicable to the Ohio River and to the Saline River. Both rivers are given specified water use designations. Minimum standards are established along with specific standards for each of the following uses: public water supply and food processing, aquatic life, recreation, and industrial water supply. The standards include requirements relating to: dissolved oxygen content, pH values, water temperature, toxic substances, chemical concentrations, bacteria, water color, odor, floating solids, and debris. Plans for implementation and enforcement are established. They include guidelines regarding the standards of treatment facilities, effluent criteria and inspection instructions. The goal of the standards is to protect and upgrade water quality. To achieve this goal, any wastes amenable to control must recieve the best practicable treatment prior to discharge. The status of municipal and in-

dustrial waste facilities along the Ohio River, the Saline River, and their tributaries is depicted by a table. (Horwitz-Florida)
W71-13672

FINANCING POLLUTION ABATEMENT WITH MUNICIPAL BONDS,
R. Gibbon.
Pollution and Waste Control, p. 133-187, 4 PL1 Criminal Law and Urban Problems (1970).

Descriptors: *Ohio, *Financing, *Project planning, *Water pollution control, Legal aspects, Water pollution, Pollution abatement, Local governments, State governments, Federal government, Administration, Administrative agencies, Regulation, Permits, Standards, Waste disposal, Solid wastes, Air pollution, Water quality control, Grants, Treatment facilities, Sewage districts, Wastes, Waste treatment.

This article describes methods of financing pollution abatement and control facilities through the use of municipal bonds. The various problems and limitations encountered in using these bonds are considered in detail. Artificial debt limitations, dual financing, and cooperation among autonomous local government units are considered to be some of the most pressing problems facing the promoter of pollution abatement facilities. The article also recognizes that pollution control and abatement often represent problems that are beyond the control of local government units. To combat this difficulty new government agencies such as the Ohio Water Development Authority have been created. The methods of financing used by local government bodies are considered in detail and compared with those methods used by the new regional governmental agencies. The use of revenue bonds is deemed an important tool in overcoming the legal regulations that presently hamper government financing. Special attention is given to the regulations and operations of the Ohio Water Development Authority, which uses financial persuasion rather than direct regulation in achieving solutions to the problems of water pollution. (Horwitz-Florida)
W71-13673

WATER QUALITY STANDARDS.
Virginia State Water Quality Control Board, Richmond.

(no date), 59 p, 16 tab.

Descriptors: *Virginia, *Water quality control, *Standards, Classification, Lakes, Streams, Water pollution control, Water policy, Water supply, Water users, Water utilization, Effluents, Waste treatment, Nutrients, Chlorides, Organic matter, Inorganic compounds, Radioactive wastes, Water properties, Oceans, Estuaries, Discharge (Water), Sewage, Industrial wastes, Dissolved oxygen.

Rules herein prescribed having general state-wide application are intended to prevent the pollution of state waters by sewage, industrial wastes, or other wastes in such concentrations as to contravene established standards or to interfere directly or indirectly with beneficial uses of such waters. Limited zones are established to allow a mixture of treated sewage, industrial, or other wastes with receiving waters. Such zones must occupy as small an area as possible and shall not prevent free passage of fish or cause fish mortality. The following standards are established to protect public water supplies at raw water intake points: (1) physical (color), (2) inorganic chemicals, (3) organic chemicals, and (4) radioactivity. The primary classification of water depends upon the climate, geography, and use of the water. There are six major classes. There are subclasses to complement major water class designations. Temperature, dissolved oxygen, and pH criteria are set forth. Waters primarily used recreationally will be assigned subclass B; all other waters will be assigned subclass A, suitable for secondary contact recreation and for use as a public water supply. A complete list of basin and section descriptions with applicable classifications and special standards is provided. A key to interpreting special standards is provided. (Rees-Florida)
W71-13674

FEDERAL POLLUTION CONTROL: PARTICIPATION BY STATES AND INDIVIDUALS ENHANCES THE NATIONAL POLLUTION CONTROL EFFORT,
T. R. Hendershot.
Villanova Law Review, Vol. 16, No. 5, p. 827-850 (1971). 24 p, 137 ref.

Descriptors: *Air pollution, *Water pollution control, *Water Quality Act, *Clean Air Act, Legislation, State governments, Administrative agencies, Standards, Water quality, Water quality control, Water pollution sources, water pollution, Rivers and Harbors Act, Federal government, Regulation, Pollution abatement, Evaluation, Public rights.

Concomitant with increasing federal pollution control legislation, participation by the states and private citizen groups has enhanced environmental protection efforts. The Clean Air Act was the first landmark air pollution legislation. State implementation plans will be carefully reviewed under 1970 amendments to the Act. Under the amendments, primary reliance is upon federal enforcement, and the availability of citizen enforcement actions is enhanced. The Water Quality Act provides national water quality standards for interstate waters. Enforcement of these standards is the duty of the Act's Administrator, but primarily reliance is placed upon lower governmental levels for abating pollution. The Refuse Act of 1899 is essentially a criminal statute prohibiting refuse discharge into navigable waters. Nevertheless, injunctive relief is available, and the Refuse Act may be used for water pollution control. Moreover, citizen qui tam actions may be available. The greatest shortcoming in modern federal pollution legislation is its failure to permit individuals to participate in enforcement. There is also too much reliance on state enforcement in the water pollution area. Federal enforcement power should be increased in the water pollution area. (Hart-Florida)
W71-13675

FEDERAL-STATE RELATIONSHIPS IN CALIFORNIA WATER QUALITY CONTROL,
California State Water Resources Control Board, Sacramento.
K. W. Mulligan.
Address to the Public Works Comm. of the U.S. House of Representatives, June 9, 1971. 11 p.

Descriptors: *California, *Federal jurisdiction, *State jurisdiction, *Water quality control, Water resources development, Planning, Water pollution, Standards, Water quality, Legislation, Rivers and Harbors Act, Federal government, State governments, Administrative agencies, Regulations, Economic efficiency, Legal aspects, Political constraints.

Section 1 of the Federal Water Pollution Control Act (FWPCA) grants the states primary responsibility for the control of water pollution. The action of the President in reviving the 1899 Refuse Act, the addition of Section 216 to the FWPCA, and the proliferation of other federal regulations, however, threaten to erode state authority and to make the state totally subservient to federal mandates. The chairman of the California Water Resources Control Board herein relates specific problems in California's program created by federal regulation. The California pollution control program is summarized. The chairman analyzes problems arising from: (1) federal enforcement of the Refuse Act, (2) federal water quality standards, (3) state jurisdiction over federal facilities, and (4) federal preemption. States with sound, enforceable and enforced water pollution control programs should be allowed to continue such programs with a minimum of federal duplication or review. This approach would avoid confusion and the needless expenditure of time, expertise, and tax dollars with no apparent environmental enhancement. (Gallagher-Florida)
W71-13676

WASTE DISCHARGE REPORTS AND REQUIREMENTS.
Califrnia State Water Resources Control Board, Sacramento.

California Admin. Code, Tit. 23, secs. 2200 thru 2232 (1970). 6 p, 1 tab.

Descriptors: *California, *Water pollution control, *Waste disposal, *Permits, Solid wastes, State governments, State jurisdiction, Administration, Administrative agencies, Water pollution, Sewage disposal, Industrial wastes, Regulation, Legal aspects, Standards, Waste treatment, Sewage treatment, Waste water disposal, Supervisory control (Power), Water pollution sources, Water pollution effects.

Each report of waste discharge or of a material change in waste discharge filed with a regional water quality control board shall be accompanied by a filing fee in accordance with the schedule herein established. Procedures for filing reports are hereby established. Such procedures require the use of forms supplied by the regional board, the completion of each form in full, and seperate reports for discharges into different disposal areas. Material changes in waste discharges that require the filing of a report include: the addition of an industrial waste discharge to a domestic discharge or the addition of a new industrial process, a significant change in disposal methods, a change in disposal areas; an increase in flow beyond established requirements, an increase in the area or depth of solid waste disposal. Solid waste sites shall be designed and operated to protect both groundwater and surface water. Solid waste disposal is prohibited if measures to prevent degradation of water are not taken. Rules are herein established to govern the monitoring of program reports, time schedules, and technical reports. (Horwitz-Florida)
W71-13677

CERTIFICATION OF CONFORMANCE WITH WATER QUALITY STANDARDS.
California State Water Resources Control Board Sacramento.

California Administrative Code, tit. 23, secs. 2340 thru 2353 (1970).

Descriptors: *California, *Standards, *Permits, *Water quality control, Administrative agencies, State governments, Water pollution, Water pollution control, Water pollution sources, Pollution abatement, Regulation, Administration, Waste disposal, Waste treatment, Federal government, Treatment facilities, Legal aspects, Legislation, Planning, Water quality, Administrative decisions.

Those persons required by federal law to obtain certification of conformance with water quality standards shall submit applications for certification persuant to regulations set forth herein. The contents of the application are listed. If the activity could affect state water quality, a report of waste discharge shall be submitted with the application for certification. Certification shall be recommended only if there is reasonable assurance that the proposed facility will not adversely affect the aquatic environment and will be in compliance with all applicable water quality control plans, waste discharge requirements, and waste discharge prohibitions. If the applicant can demonstrate that immediate certification is necessary for public health and that no significant threat to water quality will result from the proposed activity, certification may be recommended in the absence of waste discharge requirements for short-term activities. Hearings, procedures, and time limits are set forth

for implementation of these regulations. (Smiljanich-Florida)
W71-13678

DISPOSAL OF INDUSTRIAL WASTES.
For primary bibliographic entry see Field 06E.
W71-13679

PREVENTING THE POLLUTION OF FRESH WATER BY OIL, GAS, AND SALT WATER.
Louisiana State Dept of Conservation, Baton Rouge.

Statewide Order No. 29-B, October 1967 amendment. 3 p.

Descriptors: *Louisiana, *Saline water intrusion, *Oil wastes, *Water pollution control, Saline water, Regulation, Pollution abatement, State governments, State jurisdiction, Administration, Administrative agencies, Permits, Standards, Supervisory control (Power), Oil industry, Oil wells, Water pollution sources, Water pollution effects, Waste disposal, Deep-well pumping, Water quality, Water quality control.

The Commissioner of Conservation issued the following findings: (1) the pollution of fresh water supplies by oil, gas, or salt water is not in the public interest and should be prevented; (2) the Conservation Commission has the responsibility and authority to prevent such pollution and should promulgate uniform rules to accomplish this duty; and (3) good conservation practices can be served through a carefully administered system of approving applications for permits. Therefore, it is ordered that no oil field waste shall be disposed of into any stream or other body of water or into any ditch or surface drainage depression leading to any body of water. Such waste shall be retained for proper treatment. Produced salt water shall be disposed of only into: (1) subsurface formations not productive of hydrocarbons; (2) pits approved for such purpose by the Commissioner; or (3) brackish waters, tidal waters, or waters unsuitable for human consumption or agricultural purposes. Regulations prescribe when the Commissioner may issue a permit, without a public hearing, for the disposal of salt water by injection into subsurface formations. Provisions for the inspection of all permit holders and exceptions to the order are set forth. (Horwitz-Florida)
W71-13680

WATER QUALITY STANDARDS (INTERSTATE WATERS, CHICAGO RIVER AND CALUMENT RIVER SYSTEM AND CALUMET HARBOR BASIN).
Illinois Sanitary Water Board, Springfield.

Rules and Regulations SWB-15, March 1968. 22 p, 3 map, 2 tab.

Descriptors: *Illinois, *Water pollution control, *Standards, *Water quality control, Rivers, Regulation Administrative agencies, Permits, State governments, State jurisdiction, Federal government, Water pollution, Water quality, Public health, Water pollution sources, Legal aspects, Waste disposal, Treatment facilities, Project planning, Inspection, Water utilization.

These criteria prescribe the qualities or properties of water which are necessary for designated uses. If limiting conditions are exceeded such criteria shall be indicative of pollution subject to abatement. General water quality criteria herein established relate to: dissolved oxygen content; pH values; water temperature; toxic substances; chemical concentrations; bacteria; water color; odor; floating solids and debris. Specific criteria are also established for each body of water. Plans for implementation and enforcement are set forth. Time tables for the construction of municipal treatment facilities and the completion of chlorination and treatment facilities are set forth. To achieve the goal of upgrading and protecting water quality any wastes amenable to control must receive the best practicable treatment prior to discharge. Waters having higher standards than herein adopted may not be degraded without permission from the Federal Water Pollution Control Board. Included in this regulation is a summary of the water quality standards for the Chicago River and Calumet River systems. The present status of municipal waste treatment facilities is detailed in two tables. Municipal and industrial treatment requirements and effluent criteria are set forth. (Horwitz-Florida)
W71-13681

OPERATION REPORTS.
Illinois Sanitary Water Board, Springfield.
For primary bibliographic entry see Field 06E.
W71-13682

RULES AND REGULATIONS FOR PUBLIC WATERWORKS PROJECTS.
Texas State Dept. of Health, Austin. Div of Sanitary Engineering.

(rev 1970). 26 p, 3 append.

Descriptors: *Texas, *Regulation, *Water resources, *Treatment facilities, Administration, Administrative agencies, Supervisory control (Power), State governments, Public health, Water distribution, Water control, Water pollution, Inspection, Water treatment, Water supply, Water storage, Water sources, Water quality control, Water quality, Water purification, Water policy, Standards, Permits.

These rules and regulations have been adopted to insure the inclusion of all data essential for comprehensive consideration of contemplated water works projects, or improvements, additions, alterations or changes thereto, and to establish minimum standardized public health design criteria in compliance with existing state statutes and in accordance with good public health engineering practices. Procedures for considering all plans and specifications are established and require that such plans be prepared by registered professional engineers and submitted to the state health department. Limitations are placed upon the department's role in examining plans, and a detailed list of all information required on the plans is included. Water sources are regulated with respect to (1) water quality, (2) water quantity, (3) groundwater sources and development (4) surface water sources and development, and (5) springs and other water sources. Water treatment regulations are also promulgated, with special attention given to: (1) groundwaters, (2) surface waters, (3) chlorination, (4) special treatment processes, (5) sanitary facilities for waterworks installation, and (6) permits for waste discharges. Water distribution regulations are established dealing with design and standards, pressures, and other related distribution and storage considerations. (Horwitz-Florida)
W71-13683

LIABILITY OF CORPORATIONS AND CORPORATE OFFICERS FOR PUBLIC WELFARE OFFENSES: THE WATER POLLUTION PROBLEM,
J. M. Berlinger.
South Texas Law Journal, Vol. 4, p 67-80 (1959). 14 p, 58 ref.

Descriptors: *Texas, *Industries, *Water pollution control, *Legal aspects, Judicial decisions, Pollution abatement, Legislation, State governments, Regulation, Water pollution, Remedies, Water law, Public health, Non-structural alternatives, Public benefits, Adjudication procedure, Legislation.

Public welfare or regulatory crimes require no element of intent for conviction; violation of water pollution laws is such a crime. Since intent is not required, it seems logical that a corporation might be held criminally liable for violation of the water pollution laws. In McCollum v. State, the vice-president of an oil company was criminally prosecuted for his company's discharge of oil into a river. The state failed to show a personal connection between the defendant and the pollution, and the appellate court reversed the conviction on an analogy to tort law. It was pointed out that the corporation, rather than its officer, would be held liable in a tort situation. Anomalously, corporations have not been held criminally liable in Texas either. This result was reached because 'persons' in criminal statutes refers only to natural persons. Nevertheless, corporations may be held liable in tort for water pollution. The rationale of the McCollum decision now appears to refute the earlier prohibition against holding corporations criminally liable. Thus, although corporate officers are practically immune from criminal liability for violation of pollution laws, the corporation is not. (Hart-Florida)
W71-13684

STANDARDS OF QUALITY FOR PUBLIC WATERS OF OREGON AND DISPOSAL THEREIN OF SEWAGE AND INDUSTRIAL WASTES.
Oregon Administrative Rules Compilation, ch 340, secs 41-005 thru 41-105 (1970).

Descriptors: *Oregon, *Water quality, *Standards, *Water quality control, Regulation, Water pollution, Pollution abatement, Adminstrative agencies, Legislation, Legal aspects, Waste treatment, Waste disposal, Waste assimilative capacity, Water resources, Water resources development, Beneficial use, Water policy, Water conservation.

General water quality standards as well as special standards for specific water-bodies are established by these regulations. Notwithstanding the general and special standards, the highest and best practicable treatment or control of wastes shall be provided so as to maintain overall water quality at the highest possible levels. No wastes shall be discharged, nor any activities conducted that can, either alone or in combination with other wastes or activities, reasonably be expected to violate any of the general or special water quality standards. Pursuant to the established criteria, the Department of Environmental Quality shall determine the degree of waste treatment required to restore and maintain the water quality standards. The special water quality standards contained in this subsection are adopted for purposes of protecting the beneficial uses of specified waters and to conserve the waste assimilative capacity of the waters so as to accommodate maximum development and utilization of the water resources of the state. A plan for implementation and enforcement of the standards is adopted. (Gallagher-Florida)
W71-13685

THE OIL AND GAS INDUSTRY AND WATER CONSERVATION,
I. Butler.
Institute on Oil and Gas Law and Taxation, Vol. 16, p. 301-342, 1965. 42 p, 28 ref.

Descriptors: *Oil industry, *Water pollution control, *Water pollution sources, *Industrial wastes, Water pollution, Oil, Water quality control, Water pollution treatment, Pollution abatement, Pollutants, Waste disposal, Oil wastes, Saline Water, Waste water (Pollution), Waste water disposal, Brine disposal, Waste water treatment, Administrative agencies, Sticklebacks, Fish, State governments, Federal government, Legal aspects, Legislation.

Water pollution control is analyzed in this article form the viewpoint of the oil and gas industry. The greatest threat to water pollution is the prospect of a hindering morass of legislation. A brief history of water pollution demonstrates the antiquity of the problem. Water pollution problems peculiar to the oil and gas industry include refinery wastes, tanker pollution, and salt water disposal. Cooperative efforts of industry to produce efficient control pro-

grams are outlined. Refineries have made tremendous investments in treatment facilities. Realistic industrial solutions to pollution control include the use of goldfish and stickleback fish to test effluent quality. Offshore oil operations are beneficial to the fishing industry, attracting many fish to the area. Recent incidents of industrial water pollution control are cited. The role of state oil and gas regulatory authorities in preventing pollution is also discussed, with Texas as an example. The overlapping and conflicting jurisdiction of state agencies has created many legal problems. The threat of federal control raises the fear of centralization, because federal agencies would not be expected to realistically meet the problem as state authorities have. Guidelines are suggested for industrial solutions to the water pollution problem. (Smiljanich-Florida)
W71-13686

A PRACTITIONER LOOKS AT POLLUTION,
Gulf Oil Corp; Houston, Tex.
W. B. Edwards.
Institute on Oil and Gas Law and Taxation, Vol. 18, p. 423-449, 1967. 27 p, 15 ref.

Descriptors: *Oil industry, *Industrial wastes, *Pollution abatement, *Water pollution sources, Water pollution, Oil, Water pollution control, Treatment facilities, Water pollution treatment, Oil wastes, Oil fields, Waste water (Pollution), Pollutants, Brine disposal, Saline water, Oil wells, Gases, Waste disposal, Administrative agencies, Regulation, Legislation, Texas, State governments, Legal aspects.

Water pollution problems incident to the oil and gas industry are outlined, and the present and future state of control efforts is discussed. Associated with the producing segment of the industry are three operational phases primarily creating all pollution problems: (1) disposal of produced oil field brines, (2) improperly plugged and abandoned wells, and (3) secondary recovery and pressure maintenance projects. Relevant administrative procedures and remedies in Texas are detailed. The oil industry has taken a leadership position in formulating an effective pollution control program. The industry has had an active role in drafting and supporting legislation for effective measures relating to the prevention and control of pollution problems. Common and cooperative efforts within the industry are listed. Legislative, administrative, and judicial actions are compared to industry-wide actions in pollution control. Proposed legislation to combat industrial pollution includes salt water disposal regulation and the creation of waste disposal associations. Legislative provisions are set forth. The speed with which water pollution legislation is enacted makes it imperative that the legal profession cooperate, assist, and participate fully in the legislative process to insure against ill-conceived regulation detrimental to industry. (Smiljanich-Florida)
W71-13687

OIL POLLUTION CONTROL RULES AND REGULATIONS.
For primary bibliographic entry see Field 06E.
W71-13688

WATER QUALITY STANDARDS.
Connecticut Water Resources Commission, Hartford, Connecticut, 1970. 44p, 9 map.

Descriptors: *Connecticut, *Standards, *Water pollution control, *Water quality control, Water pollution, Water quality, Pollution abatement, Water pollution sources, Legislation, Administrative agencies, Legal aspects, Regulation, Federal government, Economic justification, Social needs, Interstate rivers, Intertidal areas, Watersheds (Basins).

Connecticut water quality standards approved under the Federal Water Pollution Control Act apply to all interstate and intrastate waters within Connecticut. Specific qualitative and quantitative standards have been established for inland, coastal, and marine waters; in addition, a listing of approved standards for individual watersheds has been compiled. In terms of general policy, the following principles were established: (1) recommendations as to other waste parameters will constitute a portion of the continuing effort of the commission in further defining interstate and intrastate water quality standards; (2) interstate waters whose existing quality is better than established standards will be maintained at their existing high quality; (3) in the discharge of treated effluent, cognizance shall be given both in time and distance to allow of mixing of effluent and stream; and (4) water quality standards will not be lowered unless and until it has been affirmatively demonstrated that such a change is justifiable as a result of necessary economic or social development and will not interfere with or become injurious to any presently possible uses of such waters. (Gallagher-Florida)
W71-13689

OFFSHORE OPERATIONS,
Liskow and Lewis, New Orleans, La.
A. W. Lewis, and W. M. Meyers.
Rocky Mountain Mineral Law Institute, Vol 16, p 421-462, 1971. 97 ref.

Descriptors: *Offshore platforms, *Oil industry, *Water pollution sources, *Continental shelf, Submerged Lands Act, Oceans, Coasts, Oil, Oil reservoirs, Oily water, Pollutants, Water pollution, Water pollution control, Water pollution treatment, Water quality control, Pollution abatement, Environmental effects, Leases, Industrial wastes, Regulation, Legislation, Legal aspects, Federal government.

A review is made of legal controls on offshore oil operations in order to ascertain the strengths and weaknesses in the present industrial stance with respect to water pollution. The Outer Continental Shelf Lands Act gave the federal government exclusive jurisdiction over a broad offshore area. The leasing of federal offshore lands is analyzed as to requirements, procedures, and qualifications necessary to hold federal leases. Problems of federal lease ownership include the assignment of leases to subdivisions. Because of the high cost of obtaining leases, various operators have found it necessary to join in group ownership of leases. Rules and regulations promulgated under oil leasing acts are summarized. Recent oil spill crises have been overly publicized and have led to changes in the law, including regulations, placing full responsibility for oil spills and cleanup costs on the industry concerned. New lease forms require the oil lessee to indemnify and hold the lessor United States harmless against all claims for damages resulting from water pollution. Other pollution legislation is discussed. The oil industry must convince the public that it has striven to maintain high water quality standards, even in its offshore operations. (Smiljanich-Florida)
W71-13690

THE MINING INDUSTRY AS A WATER USER AND WATER POLLUTER--LEGAL ASPECTS,
Parsons, Behle and Latimer, Salt Lake City, Utah.
J. B. Lee.
Rocky Mountain Mineral Law Institute, Vol 16, p 107-142, 1971. 35 ref.

Descriptors: *Mineral industry, *Prior appropriation, *Water pollution sources, *Water pollution control, Pollution abatement, Water pollution, Water pollution treatment, Water quality control, Preferences (Water rights), Beneficial use, Industrial water, Reasonable use, Remedies, Riparian rights, Mine wastes, Pollutants, Mining, Water utilization, Legislation, State governments, Federal governments, Legal aspects, Standards, Permits, Regulation.

The use and pollution of water by the mining industry in arid states is analyzed. In the eight most arid states, rights to divert and use streamflow for beneficial purposes may be acquired only under the appropriation doctrine, a priority of right based upon actual use. The water right is separate from rights in land, and may be lost through non-use. Appropriation rights are fixed as to amounts of water allocated. Recent cases are examined, demonstrating the practical effects of the doctrine on the mining industry. Under the doctrine, a prior appropriator may prevent the degradation of water quality by a later appropriator. Judicial remedies available to protect private rights to water quality include declaratory relief, abatement by self-help, damages, and injunctions. The suggested State Water Pollution Control Act embodies typical provisions of state water quality regulations. One of the most effective techniques of water pollution control is a permit system. Emphasis is given to water pollution regulations concerning the mining industry. Brief discussion is also given to water pollution regulations concerning the mining industry. Brief discussion is also given to recent federal legislation. It is argued that water pollution legislation must take into consideration the interests of industry. (Smiljanich-Florida)
W71-13691

OREGON'S WATER POLLUTION CONTROL PROGRAM.
Oregon State Dept. of Environmental Quality, Portland.

December 1969. 26 p, 2 illus.

Descriptors: *Oregon, *Water pollution control, *Sewage disposal, *Administrative agencies, Treatment facilities, Pollution abatement, Project planning, Water quality, Water quality control, Water pollution sources, Water pollution effects, State governments, State jurisdiction, Regulation, Administration, Legal aspects, Waste disposal, Industrial wastes, Sewage treatment, Waste water disposal, Standards, Evaluation, Legislation.

Chapter one of this publication traces the legislative history of Oregon water pollution control from the first pollution control enactment in 1889. The development of the Department of Environmental Quality is considered from its beginnings as a sanitary authority to its present role in implementing pollution control programs. From a policy of simply maintaining reasonable quality consistent with water uses, the Department has altered its objectives to a new policy of protecting, maintaining, and improving water quality for all uses. Chapter two deals with water pollution and the biology of water. It examines fundamental principles of chemistry in relation to the life cycle. The role of water pollution control in a biological sense is to keep water quality which will not upset naturally balanced animal and plant populations dwelling in the water. Chapter three examines sewage treatment by considering the chemistry of sewage and sewage treatment processes. This includes a discussion of primary, secondary, and tertiary treatment methods. Chapter four considers industrial and agricultural wastes. It lists the categories of wastes and methods for their treatment. Chapter five presents useful definitions in environmental engineering. (Horwitz-Florida)
W71-13692

WASTE DISPOSAL.
Alaska Admin Code, ch. 7, secs. 300 thru 333.

Descriptors: *Alaska, *Waste disposal, *Treatment facilities, *Sewage disposal, Regulation, Water law, State governments, Legal aspects, Water pollution, Sewers, Sewage treatment, Sanitary engineering, Sewage, Industrial wastes, Municipal wastes, Settling basins, Sludge disposal, Pumping plants, Environmental sanitation, Sedimentation, Odors, Water pollution control, Planning, Administrative agencies.

It is unlawful to dispose of sewage in such a manner as to contaminate any water supply used for drinking and household purposes, to contaminate any food crop, to create noise and offensive odors, or to pollute any lake or stream. Sewage must be collected and disposed of in properly constructed and managed sewers, treatment facilities, septic tanks, chemical toilets, privies, or by other approved methods. The discharge of untreated or insufficiently treated sewage into any lake is prohibited; the Commissioner of Health and Welfare will determine the minimum degree of sewage treatment required. The Commissioner is empowered to order the construction and use of sewage and sewage disposal facilities in certain situations. Plans for sewer or sewage works improvement must be approved by the Department of Health and Welfare. The regulations require specific detailed information about the planned facilities and specify what factors should be considered in the planning and operation of such facilities as sewers, pumping stations, screens, grit chambers, and others. Inspection of waste disposal facilities to determine their sanitary status and a penalty for violation of the regulations is also provided. (Johnson-Florida)
W71-13693

WATER QUALITY STANDARDS APPLICABLE TO NEBRASKA WATERS.
Nebraska State Dept. of Health, Lincoln. Nebraska Water Pollution Control Council.

Nebraska Water Pollution Control Council, State Dept. of Health, Lincoln, March 1971. 50 p, 2 tab, 9 append, 4 supp.

Descriptors: *Nebraska, *Standards, *Water quality control, *Regulation, Water Quality Act, Water pollution, Water pollution control, Water pollution treatment, Water quality, Administrative agencies, State governments, Public health, Water analysis, Water properties, Recreation, Water utilization, Domestic water, Solid wastes, Toxicity, Hydrogen ion concentration, Oil wastes, Oil, Non-structural alternatives, Legislation, Legal aspects.

The Nebraska Water Pollution Control Council herein promulgates water quality standards pursuant to the Federal Water Quality Act of 1965. Interstate streams to which the standards apply are listed. Six water uses are defined and explained: (1) water supply; (2) full body contact sports; (3) partial body contact sports; (4) fish, wildlife, and other aquatic and semi-aquatic life; (5) agricultural; and (6) industrial. General water quality criteria are provided, along with definitions of eighteen relevant terms. Three water use classes are established: (1) A--domestic water supply; (2) B--full body contact sports; and (3) C--agricultural, industrial, and other beneficial uses. The water use criteria are given in chart format, with ten parameters: (1) coliforms, (2) taste and odor producing substances, (3) solids, (4) toxic and deleterious substances, (5) temperature, (6) dissolved oxygen, (7) hydrogen ion concentration, (8) total dissolved solids, (9) residue oil and floating substances, and (10) aesthetic considerations. A plan of implementation and enforcement is also described. Moreover, the booklet contains ten appendices and four supplements. (Hart-Florida)
W71-13694

LAW OF THE SEA: A SYNOPSIS: POLLUTION.
For primary bibliographic entry see Field 06E.
W71-13695

FROM WHENCE COMETH OUR HELP. CONSERVATIONIST'S SEARCH FOR A JUDICIAL FORUM FOR ENVIRONMENTAL RELIEF,
Florida Univ., Gainesville.
G. W. Cornwell.
Florida University Law Review, Vol 23, No 3, p 451-458, Spring 1971. 8 p, 49 ref.

Descriptors: *Legal aspects, *Remedies, *Pollution abatement, *Administrative agencies, Administration, Administrative decisions, Federal government, State governments, Local governments, Pesticides, Florida, Wisconsin, Highways, Legislation, Planning, Judicial decisions, Canals, Environment, Ecology, Environmental effects, Land tenure, Resource development, Resource management, Non-structural alternatives.

Citizens are instituting litigation to resolve environmentally-based disputes more frequently than in the past, but, in many instances, they have not secured adequate remedies. The Cross Florida Barge Canal has been debated for a decade, and numerous suits filed, but the uncertain halt came by executive order. Similarly, the ban on DDT by the Wisconsin Department of Natural Resources began a nationwide trend towards elimination of harmful pesticides, culminating in the case of E.D.F. v Ruckelshaus, under which the Secretary of Agriculture was ordered to hold public hearings to investigate a nationwide ban on DDT. The Department of Agriculture's attempt to use Mirex to eradicate the imported fire ant has met similar opposition. In Florida, the owner of a botanical preserve unsuccessfully sought to prevent its condemnation for an interstate highway by arguing that the highway plans did not properly consider the environment. Focusing public attention on highway planning may result in improved highway methodology. Legislation to eliminate obstacles to environmental litigation, particularly acts giving citizens standing for such lawsuits, is becoming more prevalent. Traditional property concepts are also being viewed within a context of responsibility for public environmental rights. Thus, our legal system has begun to respond to the environmentalists challenge. (Hart-Florida)
W71-13696

THE AMERICAN LEGAL SYSTEM AND ENVIRONMENTAL POLLUTION,
Tulane Univ., New Orleans, La.
J. C. Juergensmeyer.
Florida University Law Review, Vol 23, No 3, p 439-450, Spring 1971. 12 p, 54 ref.

Descriptors: *Pollution abatement, *Legal aspects, *Air pollution, *Federal government, State governments, Local governments, Environment, Legislation, Interstate compacts, Pollutants, Land tenure, Financing, Government finance, Clean Air Act, Judicial decisions, Remedies, Administrative agencies, Administration, Resource development, Resource allocation.
Identifiers: *Constitution.

The inadequacy of present laws to control all types of environmental pollution is exemplified by the legal efforts to control air pollution. Despite the Clean Air Amendments of 1970, which strengthen federal enforcement provisions and allow citizen suits, federal air pollution laws still emphasize state and local enforcement. Nevertheless, Congress might constitutionally enact much stronger air pollution laws. Interstate compacts to regulate air pollution have also failed to materialize; Congress did not consent to three compacts, and a state rejected the fourth compact. Although all states have air pollution control laws, few of them have effective implementation programs, primarily because budgets are inadequate. The importance of private citizen's action groups and their activities in pollution control demonstrate the ineffectiveness of present laws. To correct the inadequacy of present environmental protection efforts, the following are required: (1) ratification of a constitutional amendment expressing the right to a clean environment; (2) recognition of environmental problems as national, rather than local; (3) recognition of property ownership as subject to the public right to a clean environment; and (4) establishment of resource allocation and management programs. (Hart-Florida)
W71-13697

LEGAL TECHNIQUES FOR POLLUTION CONTROL: THE ROLE OF THE PUBLIC,
British Columbia Univ., Vancouver School of Law.
A. R. Lucas.
British Columbia Law Review, Vol 6, No 1, p 167-191, June 1971. 25 p, 126 ref.

Descriptors: *Foreign countries, *Remedies, *Damages, *Water pollution control, Riparian rights, Water pollution, Sewage disposal, Permits, Administrative agencies, Administration, Financing, Government finance, Legislation, Judicial decisions, Legal aspects, Local governments, Environmental sanitation.
Identifiers: *Canada.

Canadian laws are inadequate to control environmental pollution. This article examines various legal techniques used to combat pollution in Canada. The common law provides civil remedies based upon a breach of some duty relating to pollution control or nuisance. These theories have been ineffective because damages beyond those suffered by the community must be proven. Various statutory controls and problems of implementation are discussed. Concerning administrative control techniques, economic incentives, such as tax deductions for pollution control devices and financial assistance to municipalities, have not been as effective as the service technique. The latter approach is aimed at reducing solid waste by recycling articles through the manufacturing process. Permit systems, general management authorities, and effluent charge schemes have also been utilized. Individual and group action should continue to play an important role in pollution control because public controls lack comprehensiveness and coordination. Administrative reorganization and the establishment of separate environmental departments are needed to improve public controls.
W71-13698

ANTI-POLLUTION LEGISLATION AND ITS ENFORCEMENT: AN EMPIRICAL STUDY,
P. Good.
British Columbia Law Review, Vol 6, No 1, p 271-286, June 1971. 16 p, 19 ref.

Descriptors: *Foreign countries, *Remedies, *Water pollution control, *Legislation, Water pollution, Damages, Oil, Ships, Local governments, Judicial decisions, Legal aspects, Regulation, Public health, Air pollution, Evaluation, Administrative agencies, Coordination.
Identifiers: *Canada.

The effectiveness of each governmental level of Canada in combating environmental pollution is evaluated in this article. Municipalities have been limited in their control efforts because they have no constitutional capacity to legislate in the area of rivers and lakes. The provincial governments have been reluctant to enforce available anti-pollution legislation. The lack of prosecutions under the Water Act and the Pollution Control Act evidences a governmental policy of abstention concerning industrial activities. Compliance with the Health Act has been attempted through education and persuasion. Only as a last resort has court action been found necessary. On the federal level, the concern under the Canadian Shipping Act has centered more on prevention than prosecution. Enforcement of the Fisheries Act has been hindered because proof of actual harm to fish is necessary. In terms of the number of prosecutions, federal legislation has been enforced more frequently than provincial legislation. Furthermore, where offenses are created, the sanctions are stiffer in the federal realm, and greater clarity is evident in the means of enforcement. (Shelnut-Florida)
W71-13699

ADMIRALTY REMEDIES FOR VESSEL OIL POLLUTION OF NAVIGABLE WATERS,
P. C. Pearson.
Texas International Law Journal, Vol 7, No 1, p 121-150, Spring 1971. 30 p, 215 ref.

Descriptors: *Admiralty, *Ships, *Water pollution sources, *Navigable waters, *Remedies, State

governments, Federal government, Public rights, Jurisdiction, Legal aspects, Water pollution control, Pollution abatement, Political aspects, Legislation, Oil, Oil industry, Judicial decisions, Adjudication procedure, Oil wastes.

Present federal and state legislation concerning oil pollution by vessels in navigable waters is herein analyzed and found to contain many weaknesses which may be redressed by more state and private admiralty actions. A basic background in admiralty law is developed through a consideration of the following topics: admiralty jurisdiction over maritime torts, in personam and in rem jurisdiction, and the limited liability of ship owners. Because the vast majority of oil tankers are foreign-owned and registered, the ability to proceed in rem against the offending vessel is deemed to provide a significant recovery fund that would otherwise be non-existent. The problems inherent in admiralty actions brought by a private citizen are examined. Actions based upon public and private nuisance are considered as possible theories that can be employed in a private admiralty suit. Increased judicial awareness of oil pollution and continuing increases in tanker traffic make it likely that admiralty courts will be receptive to original causes of action. This will provide civil remedies sufficient to deter polluters and to compensate injured parties. (Horwitz-Florida)
W71-13700

GUIDELINES FOR THE DEVELOPMENT OF WATER POLLUTION CONTROL AND ABATEMENT PLANS FOR SEWAGE DRAINAGE BASINS.
Washington State Dept. of Ecology, Olympia.

2d Edition, 1970. 39 p, 6 append.

Descriptors: *Washington, *Water pollution control, *Sewage disposal, *Long-term planning, Planning, Pollution abatement, Administrative agencies, Administration, Decision making, Standards, Coordination, Construction costs, Treatment facilities, Water pollution sources, Legislation, Legal aspects, Watersheds (Basins), Sewage districts, Adoption of practices.

Due to wide variations in the preparation and content of water pollution control and abatement plans, this planning guide was prepared to promote a higher degree of coordination, stabilization, and standardization of planning. The physical environment and social and economic growth should be considered before undertaking specific planning efforts. An inventory of present facilities and sources and characteristics of wastes must be undertaken. This involves an inventory of existing facilities and operating authorities and a determination of the sources of wastes at each planning level. Guidelines are provided for developing basin plans. Waste considerations which should be encompassed by a plan are detailed. Additionally, each basin plan should provide construction schedules as well as cost estimates and plan financing. Minimum requirements are outlined. Appendixes encompass the following areas: (1) plan preparation, (2) interagency coordination, (3) legal and administrative aspects, and (4) financing.
W71-13701

OIL AND OYSTERS DON'T MIX: PRIVATE REMEDIES FOR POLLUTION DAMAGE TO SHELLFISH,
S. C. Dorrough.
Alabama Law Review, Vol 23, No 1, p 100-133, Fall 1970. 34 p, 135 ref.

Descriptors: *Alabama, *Oysters, *Oil wastes, *Damages, Water pollution, Water pollution effects, Oil industry, Oily water, Remedies, Commercial shellfish, Food chain, Federal government, Legislation, Judicial decisions, Legal aspects, Rivers and Harbors Act, Water pollution sources.

Legal theories applicable in private suits for oil pollution damages to oyster beds are analyzed. Because of the oyster's unusual feeding process, oil pollution can destroy its commercial value, thus disrupting the food chain, by giving it an offensive taste. One who claims relief for such an injury must predicate his claim on some right of ownership. Although ownership is in the state, its permittees have private rights in the oysters. The common law forms of actions have been unsuccessful vehicles for securing restitution and abatement. In trespass actions the trend is toward tempering trespass with the requirement that the invasion be intentional, negligent, or the result of extra-hazardous activity. Negligence actions are favored by the judiciary, but proximate cause is often difficult to demonstrate. Actions to abate private nuisances are allowed when the injury to oyster beds is continuous in nature. Also, there are federal statutes supporting private actions. Under the Rivers and Harbors Act, for example, an oysterman may seek to recover through a qui tam action or by compelling governmental prosecution and claiming one-half of the penalty. (Shelnut-Florida)
W71-13702

ENVIRONMENTAL GUIDELINES FOR THE CIVIL WORKS PROGRAM OF THE CORPS OF ENGINEERS.
Corps of Engineers, Washington, D.C.

Available from National Technical Information Service as AD-716 770, $3.00 in paper copy, $0.95 in microfiche. Regulation No 1165-2-500, Appendix A, Army Corps of Engineers, Wash. D.C., November 1970. 12 p.

Descriptors: *Federal project policy, *Standards, *Environmental engineering, *Conservation, Environmental effects, Planning, Construction, Operations, Operation and maintenance, Design, Economic efficiency, Water utilization, Natural resources, Optimum development plans, Project planning, Water resources development, Aesthetics, Water pollution, Air pollution, Legal aspects, Administrative agencies.

Reconciling demands for development and utilization of resources with those for conservation calls for reorienting the Corps of Engineers' previous policy, which was primarily concerned with national economic efficiency, toward a full consideration of environmental needs. To achieve this new policy, a civilian Environmental Advisory Board has been formed to: (1) examine existing and proposed policies, programs and activities from an environmental viewpoint; (2) advise how the Corps can improve relations with the conservation community and general public; and (3) advise the Corps as to the environmental problems associated with specific projects. This new policy requires that full consideration be given to environmental values, as well as economic, social, and technical factors. In this way the Corps may help: (1) preserve unique and important ecological, aesthetic and cultural values of our heritage; (2) conserve natural resources for present and future generations; (3) enhance, maintain and restore the natural and man-made environment in terms of its productivity, variety, spaciousness and beauty; and (4) create new opportunities for people to use and enjoy their environment. To aid in implementing these objectives specific environmental guidelines are established for the planning, design, construction, and operation of Corps' projects. (Gallagher-Florida)
W71-13703

COMPREHENSIVE PLAN, NOTICE OF PUBLIC HEARING.
Delaware River Basin Commission, Trenton, N.J.
For primary bibliographic entry see Field 06E.
W71-13704

WATER QUALITY STANDARDS.
Environmental Protection Agency, Washington, D.C.

Federal Register, Vol 36, No 137, p 13203-13205 (July 1971). 3 p.

Descriptors: *Water quality control, *Standards, *Regulation, *Federal government, *State governments, United States, Legal aspects, Administrative agencies, Water pollution control, Administration, Adoption of practices, Water resources development, Planning, Conferences, Decision making, Supervisory control (Power).

Amendments to procedures for revision of water quality standards, adopted pursuant to the Federal Water Pollution Control Act, are detailed in this Environmental Protection Agency regulation. A state may, after notice and hearing, adopt revisions of its own water quality standards. These will become valid and enforceable if approved by the Administrator. If the Administrator deems it appropriate, he may call for a federal conference. Such a conference was mandatory under prior proposed regulations. If the Administrator desires revisions in the water quality standards of one or more states, he shall call a conference for the purpose of determining appropriate standards. If the Governor of a state affected by another state's standards desires revision of such standards, he may request the Administrator to initiate a conference for the purpose of revision. If a state does not adopt the revisions proposed by the conference within six months, the Administrator shall publish the revisions and they will become effective in thirty days. The promulgation also sets forth procedures relating to: (1) the initiation of conference proceedings, (2) notice of conferences, (3) service of notice, (4) parties, (5) conference organization, (6) the presentation of material, and (7) recording conference proceedings.
W71-13706

NOTICE OF PUBLIC HEARINGS (AMENDMENT OF COMPREHENSIVE PLAN).
Delaware River Basin Commission, Trenton, N.J.
For primary bibliographic entry see Field 06E.
W71-13707

WATER MANAGEMENT BUREAU.
Michigan State Dept. of Natural Resources, Lansing.

Reprint from Twenty-fifth Biennial Report, Michigan Department of Natural Resources, Lansing, 1969-1970. 14 p, 2 tab.

Descriptors: *Michigan, *Programs, *Administrative agencies, *Water pollution control, Water pollution, Administration, Planning, State governments, Water pollution sources, Water pollution treatment, Pollution abatement, Pollutants, Water resources development, Water quality control, Standards, Regulation, Legislation, Data processing, Legal aspects, Chemical wastes, Public health.

The activities of the Michigan Water Resources Commission and its various divisions are summarized in a biennial report for 1969-1970. During that period the Commission intensified protection of Michigan's lakes and streams through enforcement of high water quality standards. New laws are described which strengthen the anti-pollution effort, along with new pollution prevention programs initiated by the Commission. Mercury and other toxic wastes were studied in an attempt to halt further chemical waste pollution by industry. The Water Quality Control Division is responsible for administering Michigan's water pollution control program. Units of the division handling specific enforcement duties are described. Health hazards from water pollution were studied. Personnel conducted ten comprehensive studies of river water quality. Exploration of possible forms of improved data processing in water pollution control led to

some reorganization. Development and maintenance of a comprehensive water resource planning process was continued. State and federal construction grant programs significantly contributed to pollution abatement. The Hydrological Survey Division handles most engineering and submerged land management programs. Investigations produced basic data on streamflow, lake levels and underground water quality and quantity. The biennial period saw an improvement in water quality. (Smiljanich-Florida)
W71-13708

ENVIRONMENTAL PROGRESS DURING 1970.
Michigan Water Resources Commission, Department of Natural Resources, Lansing, Michigan, January 1971. 7 p.

Descriptors: *Michigan, *Water pollution control, *Programs, *Water pollution sources, Water resources development, Water pollution, Water pollution treatment, Pollution abatement, Water quality control, Phosphates, Chemical wastes, Pollutants, Thermal pollution, Legislation, Regulation, Administrative agencies, Ships, Waste disposal, Metals, Industrial wastes, Lake Erie, Legal aspects.

Significant environmental programs and developments in Michigan are summarized for the year 1970. With recent legislative enactments, the state's pollution control statute is the most comprehensive in the nation. Results of monthly meetings of the Water Resources Commission are listed. The phosphorus removal program decreased the amount of phosphorus entering water bodies, but concern developed over the pollution potential of substitute chemicals. Mercury pollution in the Great Lakes was a major problem. A fishing ban was initiated, and industries using mercury in manufacturing processes were ordered to halt further discharge of mercury. Legislation was proposed to control mercury pollution. A survey was made of industrial uses of metals which, if discharged, could contaminate lakes and streams. A proposed rule would limit discharges of such metals. Contamination of wells through improper salt storage led to a proposed rule prohibiting such pollution of groundwater. The Vessel Pollution Control Act regulates the use of portable holding tanks for wastes on vessels. Direct and indirect water discharge of sewage is a violation of the statute. Other developments discussed include disposal of polluted dredge spoil, pollution conferences, thermal pollution, and Lake Erie pollution. (Smiljanich-Florida)
W71-13709

REPORT OF THE FAO TECHNICAL CONFERENCE ON MARINE POLLUTION AND ITS EFFECTS ON LIVING RESOURCES AND FISHING.
Food and Agriculture Organization (UN), New York. Fishery Resources Div.
For primary bibliographic entry see Field 05C.
W71-13723

EVALUATING WASTE DISPOSAL AT SEA -- THE CRITICAL ROLE OF INFORMATION MANAGEMENT,
Bisset-Berman Corp., San Diego, Calif.
For primary bibliographic entry see Field 05E.
W71-13726

POLLUTION MANAGEMENT IN THE COASTAL STATES,
Ocean Science Center of the Atlantic Commission, Savannah, Ga.
T. E. Suddath.
In: Marine Technology Society 7th Annual Conference, August 16-18, 1971, Washington, D.C., p. 431-436.

Descriptors: *State governments, *Water pollution control, *Administrative agencies, Administration, Long-term planning, State jurisdiction, Federal jurisdiction, Legislation, Pollution abatement.
Identifiers: *Pollution management, *Coastal states, Coastal States Organization.

A case is made for a balanced approach to pollution management in which each coastal state examines its priorities and determines if the pollution management problems in the coastal zone would be of such dimensions as to establish a coastal regional planning and management activity. It is suggested that a 'State EPA' is the most logical structure to be the connecting link for funding and communicating pollution control standards back and forth between Federal and State governments. (Currer-PAI)
W71-13728

SEWAGE DISPOSAL FROM PLEASURE BOATS,
Michigan Univ., Ann Arbor. Dept. of Naval Architecture and Marine Engineering.
J. B. Woodward, III.
In: Marine Technology Society 7th Annual Conference, August 16-18, 1971, Washington, D.C., p 601-628. 11 fig.

Descriptors: *Sanitary engineering, *Boats, *Sewage disposal, Boating regulations, Naval architecture, Water pollution control, Waste water treatment.
Identifiers: *Marine toilet design, *Holding tanks, Pleasure boats, Motor cruisers, Sailboats.

The impact of pollution regulations on the design of sanitary facilities onboard pleasure craft is examined. Several types of non-discharging sewage systems are listed and discussed as to their suitability for pleasure craft. Seven different typical pleasureboats are described and analyzed; the effects of holding tank weight, such as extra propulsive power and fuel consumption, and change in stability, are estimated. The possible advantages of using one or more of the alternative schemes is then discussed. (Currer-PAI)
W71-13736

ENVIRONMENTAL LAW - CONGRESS HAS AUTHORITY UNDER THE COMMERCE CLAUSE TO PROTECT MARINE ECOLOGY IN INTRASTATE WATERS - CORPS OF ENGINEERS TO TAKE ENVIRONMENTAL CONSIDERATIONS INTO ACCOUNT IN THE MANAGEMENT OF NAVIGABLE WATERS.
Villanova Univ., Pa.

Villanova Law Review, Vol. 16, 1971, p 766.

Descriptors: *Legal aspects, *Water utilization, *Riparian rights, Navigable waters, Project planning, Legislation, Riparian land, Water zoning, Water resources development.
Identifiers: River and Harbors Act of 1899, U.S. Army Corps of Engineers.

Zabel v Tabb, the first case to examine the propriety of the Army Corps of Engineers' use of ecological factors as a determinant in granting construction permits under the Rivers and Harbors Act of 1899, is reviewed. The issue decided upon was whether Congress could prohibit a project on private riparion submerged land in navigable waters for ecological reasons or had relinquished this power to the state -- or had delegated it to the Secretary of the Army. (Currer-PAI)
W71-13743

THE ENVIRONMENTAL LAW EXPLOSION - A SURVEY OF ANTI-POLLUTION LAWS AFFECTING THE OIL INDUSTRY,
Pace Coll., New York.
G. A. Bond.
Business Lawyer, Vol 26, 1971, p 1039.

Descriptors: *Legal aspects, *Water Quality Act, *Oil-water interface, Oil industry, Legislation, Oil reservoirs, Expoitation, Exploration, Drilling, Resource development.
Identifiers: Rivers and Harbors Act of 1899, Water Quality Act of 1965, Air Quality Act of 1969, Water Quality Improvement Act of 1970, Pollution of the Sea by Oil Act of 1961.

The petroleum industry is used as a focal point for the survey of emerging environmental laws. Existing and emerging regulations are studied from the perspective of the four functional categories of oil industry operations: production, transportation, refining, and marketing. (Currer-PAI)
W71-13744

TWO-DIMENSIONAL WIND SETUP OF OIL ON WATER,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W71-13749

COASTAL WATER POLLUTION, POLLUTION OF THE SEA BY OIL SPILLS.
North Atlantic Treaty Organization, Brussels (Belgium).

Colloquium on Pollution of the Sea by Oil Spills, N.A.T.O., Committee on the Challenges of Modern Society, November 2-6, 1970, Brussels, Belgium. 398 p.

Descriptors: *Water pollution control, *Pollution abatement, *Oil wastes, *Cleaning, *Planning, Governments, Industry, Environmental effects, International law, Jurisdiction.
Identifiers: Removal procedures, International cooperation.

This international colloquium heard representatives from Belgium, Canada, Denmark, France, Germany, Greece, Iceland, Italy, Norway, Netherlands, Portugal, Turkey, Spain, Great Britain and the United States speak on the grave problem of pollution of our oceans by oil. These representatives presented papers on standards, regulations, preventive measures, oil removal methods, cleaning methods and the effects on the marine environment. Twenty seven papers are included. (See also W71-13752 thru W71-13778) (Ensign-PAI)
W71-13751

PREVENTION OF OIL POLLUTION BY SHIPS,
Coast Guard, Washington, D.C.
R. Y. Edwards.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 1.1-1.7.

Descriptors: Water pollution control, *Oil wastes, *Ships, *Pollution abatement, United States, Boundaries, Jurisdiction, Regulation, Safety, Transportation.
Identifiers: *U.S. Coast Guard, Traffic, Cargo handling, Ballast discharge, Shore facilities, Liability.

The responsibility and jurisdiction of the United States Coast Guard covering United States ships in marine safety and oil spillage are reviewed. They control the inspection and approval of those vessels carrying bulk inflammables and combustible liquids as well as enforcing discharge zone limits. There are civil penalties for discharge in American and contiguous waters, a provision for liabilities in cleanup costs, preventional measures of threatening spills, and regulations for the prevention of such discharges. The Water Quality Act of 1970 imposes fines and prison penalties for failure to report spillage in United States waters. The merchant fleets of the world should be unrestricted, because there are no recognized international boundaries. Stricter design standards are being promulgated for United States tanker ships. Under study are the ocean surface areas, advisory service for port traffic and cargo handling and shoreside facilities for the reception of bilge and ballast discharges. (See also W71-13751) (Ensign-PAI)
W71-13752

AVOIDANCE OF ACCIDENTAL AND DELIBERATE POLLUTION,
Department of Trade and Industry, Washington, D.C.
G. Victory.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 2.1-2.10.

Descriptors: Water pollution control, *Oil, *Oil wastes, *Accidents, Exploration, Ships, Navigation, Regulation, Training, International waters.
Identifiers: *United Kingdom, *Oil spills, Intergovernmental Maritime Consultative Organization.

The United Kingdom discusses the handling of oil spillages and its close association and usage of services offered by the Intergovernmental Maritime Consultative Organization. Interest is in the avoidance of accidental and deliberate oil spillage, with suggestions for immediate useful implementation and the studies which have been made or are under study by the I.M.C.O. It is suggested that member governments accept the 1969 Amendment to the International Convention for the Prevention of Pollution (1954), instituting international enforcement. Effective cooperation should be organized in the prosecution of offenders. Safety increases in casualties causing accidental pollution have been studied, such as routing, navigational aids, revised collision regulations, training and maneuverability. Recommendation is made that the prevention of offshore spillage in petroleum exploration be the responsibility of national governments. (See also W71-13751) (Ensign-PAI)
W71-13753

SHIP CONSTRUCTION AND OPERATION STANDARDS FOR OIL POLLUTION ABATEMENT,
Maritime Administration, Washington, D.C.
Scott E. Dillon.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 3.1-3.9.

Descriptors: Water pollution control, *Oil wastes, *Ships, Operations, *Standards, *Pollution abatement, Emulsions, Reclamation.
Identifiers: *Tankers, Ballast systems, Load-On-Top, Separators, Oil meters, Interface detectors.

The merits of Load-On-Top procedure in oil tankers are reviewed at length, with ample descriptions of the mechanical operation. Although tanker operators would find a large financial imposition in converting the present tankers, in theory it is felt that this procedure would be an interim solution. The ballast systems should be studied on all types of ships. Two goals are set forth: universal adaptation by all tankers to the Load-On-Top procedure who carry crude and heavy oils, and further research and development of oily-water separators, oil content meters and interface detectors. There should also be improved methods for the breaking down of emulsions. Ship design is discussed and it is suggested that studies should be supported and a universally agreed tank size endorsed. Oil terminals, facilities in reception of processing, and waste reclaiming remain inadequate. (See also W71-13751) (Ensign-PAI)
W71-13754

DESIGN AND OPERATIONS FOR OIL TRANSFER OFFSHORE TERMINALS,
Standard Oil Co., Linden, N.J. Transportation Div.
R. E. Howe.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 4.1-4.11.

Descriptors: *Oil, *Transfer, *Operations, *Design, *Pollution abatement, Regulation, Governments, Industries, International law, Water pollution control.
Identifiers: *Tanker terminalling, Sea islands, Buoy moorings, Single buoy moorings.

Tanker terminalling and its methods as a means to reducing marine pollution are discussed. Although oil companies and tanker operators as well as port authorities and Army Navy cooperation are at a high level, international regulations enforcement governing tanker design and oil handling operations are vital to success. Industry could cooperate more effectively. Construction codes would be meaningless because terminalling facilities are custom tailored to the physical environment. Constant communications between industry and governments in terminal planning are necessary to handle the increasing oil movements. The offshore terminal is recommended as one of the most satisfactory for spillage control, because many ports cannot be upgraded to meet the future requirements and the larger built tankers will be unable to enter many ports. Three main types of terminals are described: sea islands, multi-buoy moorings and single buoy moorings. Equipment and operation of these offshore systems are discussed. (See also W71-13751) (Ensign-PAI)
W71-13755

DESIGN AND OPERATIONS REQUIREMENTS FOR OIL TRANSFER, OFFSHORE TERMINALS (ANNEX), DETAILED DESIGN AND OPERATIONS REQUIREMENTS FOR OIL TRANSFER, OFFSHORE TERMINALS,
Esso Research and Engineering Co., Linden, N.J.
J. Mascenik.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 4.12-4.48. 9 fig, 6 ref.

Descriptors: *Oil, *Transfer, Operations, Design, Ships, *Pollution abatement, Regulation, Pipelines, Testing, Training, Water pollution control.
Identifiers: *Tanker terminalling, *Offshore terminals, Mooring, Berthing.

Detailed descriptions are given in offshore terminalling. The usage of three types of berths, their designs and their operational limitations, as well as submarine pipelines are dealt with fully. Due to the dissimilarity of berthing, mooring, and cargo transfer, each facility requires a thorough survey of the physical environment. To establish bases, a comprehensive knowledge of acting forces on the vessels is necessary. Model test data are used to determine whether conditions are safe for the mooring of tankers. Established criteria and procedures must be analysed before design loads are made for the various components. Severest conditions are considered necessary to design for maximum loads on the facility while a tanker is not berthed. Stringent tests are made following installation of facilities prior to usage. Training of both ship and shore crews is essential to satisfactory operation. (See also W71-13751) (Ensign-PAI)
W71-13756

FEDERAL REGULATIONS AND POLLUTION CONTROLS ON THE U.S. OFFSHORE OIL INDUSTRY,
Geological Survey, Washington, D.C. Conservation Div.
Russell G. Wayland.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 5.1-5.9.

Descriptors: *Oil industry, United States, Federal government, *Regulation, Water pollution control, Drilling, Offshore platforms, Wells, Leases, Materials, Equipment, Cleaning.
Identifiers: *Santa Barbara Blowout, *Gulf of Mexico.

New, more stringent regulations are clearly spelled out regarding offshore drilling. Specific data on the Santa Barbara Blowout and the Gulf of Mexico, are given. Leases are not offered until operators file exploratory drilling plan, drilling application and development plans including platform and development wells. Rules on structural equipment regulations are specific, as on cement and other materials. There are new requirements on preventive blowout equipment and crew drills are required weekly. Mud conditioning practices are tightly regulated and new production platforms must have gas detectors, alarm systems, shutdown devices and water separation equipment. Study is in progress by the Geological Survey to update older systems. Operators are required to report any spill over fifty barrels and are responsible for cleanup. A glossary of technical terms is included. (See also W71-13751) (Ensign-PAI)
W71-13757

REPORT OF OIL SPILLAGE TRIAL - JUNE 1970,
Royal Naval Scientific Service, London (England).
E. N. Dodds.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 7.1-7.8. 3 tab.

Descriptors: Water pollution sources, *Oil, *Emulsions, Photography, Weathering, Pollution abatement.
Identifiers: *Torrey Pine oil spill, Dean and Starks apparatus.

Description of on-the-scene methods are given in a review of the Torrey Pine oil spill trials. The trial objective was to obtain samples of oil and water over a prolonged period and to check emulsion formation. Visual and photographic observations were included. A short narrative describes the work done for four days following the disaster. Water and oil samples were tested by means of Dean and Stark apparatus, the results of which are tabulated in the accompanying Table 2. The behavior and character of the Kuwait crude oil has indicated that research in the areas of weathering done in the open sea cannot be satisfactory in uncontrolled slicks. (See also W71-13751) (Ensign-PAI)
W71-13758

DETECTION BY SATELLITE,
North Atlantic Treaty Organization, Brussels (Belgium). Div. of Scientific Affairs.
Amos J. Shaler.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 8.1-8.4.

Descriptors: Water pollution control, Ships, Oil wastes, *Accidents, *Satellites (Artificial), *Infrared radiation, *Remote sensing, Photography.
Identifiers: Nimbus IV pictures, Berridge formula, N.A.T.O., U.S. National Environmental Satellite Center, Oil detection.

Monitoring of oil spills which are unreported either by virtue of illegal discharges or non-tanker vessel accidents have become important in controlling marine pollution. Experiments are being done in Great Britain with earth-scanning satellites and infrared cameras. Although satellite usage for weather prediction has been in use for a number of years the meteorological films have been little studied for possible presence of oil discharge. Satellite films taken at the time of the Torrey Pines disaster revealed also that cloud formation and condensation in the atmosphere prevented satisfactory films. The inadequacies of the infrared Nimbus IV pictures are discussed as are those of the Berridge formula. Further study using the central communication network within N.A.T.O. and the facilities of the U.S. National Environment Satellite Center, present and planned, seems feasible. (See also W71-13751) (Ensign-PAI)
W71-13759

SCIENTIFIC ASPECTS OF THE OIL SPILL PROBLEM,
Woods Hole Oceanographic Institution, Mass. Dept. of Chemistry.
Max Blumer.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 9.1-9.24. 13 ref.

Descriptors: Water pollution effects, *Oil wastes, *Toxicity, *Ecology, *Leases, *Cost repayment, Cleaning, Pollution abatement, Water pollution control.
Identifiers: *Oil spills, Assessment.

Oil spillage estimates are presented in terms of millions of tons, and with the opening of new oil fields and larger tankers, a world assessment of the marine oil pollution situation is urgently needed. Scientific oil spillage studies have shown oil and oil products to remain poisonous for long periods of time, the hydrocarbons and carcinogens proving fatal to ecology, fisheries and man. Countermeasures thus far have proved to be inadequate as well as dangerous to the marine environment. Basic research and development is needed in ecology and it is suggested that added funds be included in all oil lease costs to contribute to environmental protection. (See also W71-13751) (Ensign-PAI)
W71-13760

EFFECTS ON FISHERIES AND THEIR EVALUATION,
Ministry of Agriculture, Fisheries, and Food, London (England).
R. G. J. Shelton.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 10.1-10.8. 9 ref.

Descriptors: Water pollution control, *Oil wastes, *Dispersion, *Fisheries, *Toxicity, Cleaning, Operations, Water pollution effects.
Identifiers: Oil types, Spill circumstances, Cleaning methods.

Oil as a pollutant is one of the major problems to the fishing industry. Because of the tendency to taint commercially important species and the extent of toxicity of some oils and oil dispersants to marine organisms it is necessary to know the type of oil spilt, the circumstances of the spill and the clearing up methods used. The various clearing operations are discussed from the fisheries viewpoint and recommendations to reduce the damage to fisheries are made. (See also W71-13751) (Ensign-PAI)
W71-13761

OIL POLLUTION AND SEABIRDS,
Nature Conservancy, Abbots Ripton (England). Monks Wood Experimental Station.
J. L. F. Parslow.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 11.1-11.12. 3 tab, 14 ref.

Descriptors: Water pollution effects, *Oil wastes, *Birds, *Toxicity, *Populations, *Mortality, Pollution abatement, Breeding, Water pollution control.
Identifiers: *Auks, *Puffins.

One of the effects of oil pollution is the suffering and mortality of seabirds. Declines in seabird populations due to oil pollution have been reported from North America, Northern Europe, South Africa and elsewhere. In Britain oil pollution was found to be mainly responsible for the declines in auk colonies over the past few decades. To conserve the auk population further control of pollution and promotion of breeding colonies are necessary. More must be learned as to what happens to birds out at sea. As an example, puffins, rarely found dead on beaches, are rapidly declining in the British Isles and particularly on St. Kilda where there were previously huge colonies. (See also W71-13751) (Ensign-PAI)
W71-13762

EVIDENCE OF HYPERPLASIA IN AN ESTUARINE BRYOZOAN ATTRIBUTABLE TO COAL TAR DERIVATIVES,
National Museum of Natural Sciences, Ottawa (Ontario).
J. Fish, N. A. Powell, C. S. Sayce, and D. R. Tufts.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 12.1-12.5. 3 fig, 3 ref.

Descriptors: *Estuaries, Water pollution effects, *Coal tar coating, *Oil wastes, *Coatings, *Invertebrates, *Oysters.
Identifiers: *Bryozoan, *Schizoporelli unicornus, Hyperplasia.

The abnormal reproductive response to coal tar derivatives by a marine invertebrate in a polluted environment was studied. Normal colonies of oyster shells were taken from the reefs to a Boat Basin (contaminated by creosote leaching, gas and diesel oil and bilged engine oil). The encrusted shells were threaded and suspended just beneath the surface of the water, using nylon rope. Shells were then placed on the oyster station trays or attached to them with a string of polyvinylchloride. Abnormal colonies appeared in nine days at the Boat Basin, seven days at the oyster stations. This documented study, the first on the experimental induction of hyperplasia in the estuarine bryozoan Schizoporella unicornis was believed to be caused by one or more carcinogens in coal tar derivatives in the uncontrolled growth of the ovicells. Qualitative monitoring of coastal estuaries might be developed by using Schizoporella unicornis. (See also W71-13751) (Ensign-PAI)
W71-13763

DEALING WITH OIL POLLUTION BOTH ON THE SEA AND ON THE SHORE,
Warren Spring Lab., Stevenage (England).
J. Wardley Smith.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 14.1-14.10.

Descriptors: Water pollution, *Oil wastes, *Sea water, Shores, Pollution abatement, Water pollution control, Cleaning, Cost comparisons, Education.
Identifiers: *United Kingdom.

In studying pollution of both sea and shore by oil the author feels the United Kingdom copes with beach cleaning more effectively and at less cost than other countries. The work described is not complete and new methods are constantly suggested and evaluated. The best way to deal with all types of pollution must be studied and educational programs on pollution control should be effected throughout the world. (See also W71-13751) (Ensign-PAI)
W71-13764

U.S. TECHNOLOGY IN OIL SPILL CONTAINMENT AND CLEAN UP,
Department of the Interior, Washington, D.C. Office of Oil and Hazardous Materials.
Allen Cywin, and Kenneth E. Biglome.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 15.1-15.33.

Descriptors: *Water pollution control, *Oil wastes, *Cleaning, Technology, Governments, Industry, Salvage value, Navigation, Surveys, Photography, Materials, Equipment.

The United States research and development program for new technology in oil spill prevention and removal is rapidly moving forward. There is close coordination between industry and government in research and technology development on the prevention, clean up and containment of oil spills. Details are given on salvage operation methods, navigational aids, surveillance methods, and day and night monitoring capabilities. Oil removal systems are being improved and photographs and schematic views are presented of oil harvesters and skimmers at work on the Santa Barbara blowout. Procedures for modified earthmoving equipment have been developed for beaches. Other methods are under study for sand cleaning including a froth floatation type of cleaning plant being presently demonstrated on an artificially contaminated beach. Comprehension of the problems is growing apace with technological development. (See also W71-13751) (Ensign-PAI)
W71-13765

A METHOD OF RECOVERING OIL FROM A SUBMERGED TANKER,
Defence Research Board, Ottawa (Ontario).
H. Sheffer.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil spills, November 2-6, 1970, Brussels, Belgium, p 19.1-19.4.

Descriptors: Water pollution control, *Pollution abatement, Ships, *Oil wastes, Transfer, Salvage value, Operations, Equipment, Application methods.
Identifiers: *Tankers, *Oil removal, 'Hot-tap', Recovery method.

The submerged tanker which broke and sank in Nova Scotia in 1970 is used as an example of demonstrating the recovery method of 'hot-tap', used in oil refineries. Approximately one-third of the cargo was intact in the stern, (5,000 tons of Bunker C fuel oil). Removal was urgent. This fuel oil had to be maintained at an elevated temperature to remain fluid, which complicated removal since it was near freezing. For raising the cargo temperature, live steam was injected. A detailed description is given on the equipment and facilities utilized as well as the efficiency of the diving team, working under extremely adverse conditions. The emergency methods used were considered practicable. Contamination could have been lessened by debunkering the oil before the tanker sank. The removal of oil from a tanker wreck should have first priority, with salvage operations following. (See also W71-13751) (Ensign-PAI)
W71-13766

SEA TRIAL OF THE SHELL OIL-SINKER METHOD,
Koninklijke/Shell-Laboratorium, Amsterdam (Netherlands).
H. G. Van Laar.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 20.1-20.20.

Descriptors: *Water pollution control, *Oil wastes, *Cleaning, Distillation, Chemicals, Sands, Emulsions, Gravity, Materials, Environmental effects.
Identifiers: Oil-Sinker method, Shell, Oleophilic particles.

Tests for combatting large scale oil spills were conducted after years of research and development. The method used is described as a 'rough and ready' procedure. Kuwait crude oil was partially distilled to simulate the condition of floating sea oil of several days duration. A chemical also was added to simplify surface and bottom sea sample identity. Weather conditions, oil area measurements and velocity of equipment were reported. The Shell Sand Sink method was used whereby sand weight sank the oil to the bottom. Experiments revealed that hydrophilic particles cannot

permanently hold the oil on the bottom, but with oleophilic particles, such as flowers to sulphur, the oil will adhere firmly and cannot be affected by water displacement. The properties, efficiency and storage of various materials are evaluated. This method was thought to be quite satisfactory for large spills. (See also W71-13751) (Ensign-PAI)
W71-13767

A METHOD OF TREATMENT BY BURNING,
Waterways (Netherlands).
Van Engeren.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 21.1-21.2.

Descriptors: *Water pollution control, *Oil wastes, *Cleaning, *Sea water, Shores, Burning, Sand.
Identifiers: Netherlands, Kontax ignition agent, Trials.

On July 1, 1969 small-scale trials and full-scale trials for oil removal with the ignition agent 'Kontax' were effected both at sea and on the shore. The oil burned spontaneously and when completely burned out freshly dumped oil was mixed with sand and set on fire. The sea experiments were more successful than the beach trials. The quantity of 'Kontax' to be used depends on the thickness of the layer, wind, sea state etc. A 'Kontax' catapultion method for shipboard use is being devised. (See also W71-13751) (Ensign-PAI)
W71-13768

THE BIOLOGICAL PROBLEMS OF THE STRUGGLE AGAINST HYDROCARBONS BY COUNTERMEASURES, LE PROBLEME BIOLOGIQUE DE LA LUTTE CONTRE LES HYDROCARBURES PAR TENSIOACTIFE,
Institut Royal des Sciences Naturelles de Belgique, Brussels.
E. Peeters.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 22.1-22.7.

Descriptors: Water pollution effects, *Oil wastes, *Emulsifiers, *Detergents, *Toxicity, *Evaporation, *Biological communities, Coasts, Environmental effects, Currents, Turbulence, Depth, Sediments, Water pollution control.
Identifiers: *Belgium.

The toxicity of products used in the struggle against oil pollution of the sea is considered for the hazard they present to marine life. This study was made on the Coast of Belgium where currents, depth, turbulence and sediments were considered as important to the effects on the biological communities exposed to the toxic products. The advantages and disadvantages of the various products are discussed and it can only be hoped that eventually something will be found that is more efficacious and less toxic. (See also W71-13751) (Ensign-PAI)
W71-13769

THE PROCESS OF THE STRUGGLE AGAINST ACCIDENTAL POLLUTION BY HYDROCARBONS, ADVANTAGES AND INCONVENIENCES OF THE DIVERSE PROCESSES; LES PROCEDES DE LUTTE CONTRE LES POLLUTIONS ACCIDENTELLES PAR LES HYDROCARBURES,
Ministere de la Marine Marchande, Paris (France).
M. Duclaux.
N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 23.1-23.19.

Descriptors: *Water pollution control, *Oil wastes, *Accidents, Ships, Equipment, Materials, Barriers, Absorption, Chemical precipitation, Emulsifiers, Dispersion, Toxicity, Environmental effects.
Identifiers: France, Torrey Canyon disaster.

From the experience gained from the 'Torrey Canyon disaster' and from other accidental oil spills the various solutions which were found most suitable are presented. Shipboard devices, floating barriers, and various products such as absorbants, chemical precipitants, emulsifiers and dispersants are discussed. These products, both French and foreign, number around 150. All of these solution's advantages such as efficacy, rapidity and convenience, are weighed against the disadvantages of toxicity to the marine environment. (See also W71-13751) (Ensign-PAI)
W71-13770

FACTORS TO BE CONSIDERED IN FORMULATING A NATIONAL PLAN TO COMBAT OIL SPILLS,
Defence Research Board, Ottawa (Ontario).
H. Sheffer.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 25.1-25.46.

Descriptors: *Water pollution control, *Oil wastes, Ships, *Transfer, *Cleaning, Operations, Materials, Equipment, Environmental effects.
Identifiers: Canada, Debunkering, Tankers, Oil recovery.

This documentation of data dealing with the wrecked tanker Arrow in Nova Scotia in 1970 is presented as a manual of guidelines in debunkering oil in submerged tankers. Eleven spills are listed. This is a complete and comprehensive summary of the steps taken to staff, headquarter, and mobilize equipment and materials. The operations are carefully tabulated, and covered are the community relations, effects on ecology, removal methods of oil spillage and the costs of the operations. (See also W71-13751) (Ensign-PAI)
W71-13771

MAJOR OIL SPILL IN NAVIGABLE WATERS, 'THE ARROW INCIDENT', ADMINISTRATION, ORGANIZATION AND RESPONSE,
Imperial Oil Ltd., Toronto (Ontario).
W. M. O'Connell.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 26.1-26.6.

Descriptors: *Water pollution control, Ships, *Oil wastes, *Transfer, *Cleaning, Operations, Salvage value, Equipment, Personnel, Management, Governments, Industry.
Identifiers: *Nova Scotia, *Tanker Arrow.

Countries with extended coast lines whose economy can be threatened by loss of fisheries and tourism are gravely concerned with oil pollution. Frequent inspection, supervision of loading and discharging of cargoes in port, and law enforcement vigorously applied to regulations violators are necessary steps in preventive measures. A review of the tanker Arrow wrecked in Nova Scotia in 1970 is given, citing the difficulties of weather and of obtaining the necessary equipment and personnel for emergency oil salvage operations. Of vital necessity is vesting an on-the-scene member with authority to expend monies in cleanup operations. This support should come through agencies of the government. Stock piles of oil clean up equipment and materials should be kept in central locations for expediency. A cooperative is being organised by oil companies and local governments to pool personnel and equipment for fast spillage cleanups. (See also W71-13751) (Ensign-PAI)
W71-13772

EXECUTIVE ACTION - NATIONAL PLANS,
Department of Trade and Industry, Marine Division, Great Britain.
D. N. Byrne.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 27.1-27.8.

Descriptors: *Water pollution control, *Oil wastes, *Accidents, *Communication, Cleaning, Equipment, Application methods.
Identifiers: *United Kingdom, Alarm system, National plans.

The United Kingdom has organized a communications alert system covering marine oil spills. Twenty two items are outlined on the handling and dissemenation of warnings of spills, the selection of cleanup methods, and routines to be used in notifying authorities of spills. A list of Government Agencies handling the communications, costs and reimbursements is cited. The Board of Trade distributes reports to its Principal Officers on the action taken in specific incidents to aid them in their programs. All major spills are reported to IMCO who is also informed of all methods used in treating oil spills as well as new developments in equipment. The greatest importance is attached to the exchange of ideas and experiences. (See also W71-13751) (Ensign-PAI)
W71-13773

NATIONAL CONTINGENCY PLANNING,
Department of Transportation, Washington, D.C.
F. D. Heyward.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 28.1-28.12.

Descriptors: *Water pollution control, *United States, Federal Government, *International law, *Oil wastes, *Pollution abatement, *Planning, Future planning (Projected), Governments, Coordination.
Identifiers: *Contingency planning.

The United States' national experience in the development of its National Oil and Hazardous Materials Contingency Plan is outlined. Conclusions and recommendations are made. The author feels that the delineation of policy, authority and responsibility must be clear cut and positive, adequate funding for immediate response activities is necessary, and the necessary response equipment must be adequate and available. The need for an international program addressed specifically to the problem of oil and its effects on the marine environment is emphasized. (See also W71-13751) (Ensign-PAI)
W71-13774

EMERGENCY PLAN PRESENTLY UNDER STUDY IN ITALY FOR DEALING WITH ACCIDENTAL OIL POLLUTION OF THE SEAS.
Ministero della Marina Mercantile, Rome (Italy).

In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 29.1-29.5.

Descriptors: *Water pollution control, *Planning, *Cleaning, *Operations, *Equipment, Transportation, Ships, *Oil wastes, Accidents, Transfer, Sea water, Shores.
Identifiers: *Italy.

The Ministry of the Mercantile Marine of Italy have prepared a plan to cope with oil pollution in the sea as a result of collisions, running around, explosions and other causes. The technical divisions of public administration is in collaboration with oil and shipping experts to find the best way to combat large-scale pollution after it has occurred. The basic points of the plan are set forth. The needs are outlined, the operational techniques traced and facilities, equipment and materials named for emergency removal and cleanup of sea and shore. The plan is still under study. (See also W71-13751) (Ensign-PAI)
W71-13775

PLAN OF STRUGGLE AGAINST THE ACCIDENTAL AND MASSIVE POLLUTIONS FROM HYDROCARBONS REJECTED INTO THE SEA, PLAN DE LUTTE CONTRE LES POLLUTIONS ACCIDENTELLES ET MASSIVES PAR HYDROCARBURES REJETES EN MER,
Ministere de l'Interieur, Brussels (Belgium). Service de la Protection Civile.
M. R. Pianet.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 30.1-30.6.

Descriptors: *Water pollution control, *Oil wastes, *Accidents, *Planning, *Surveys, *Communications, Governments, Oil industry, International law, Regional analysis, Local governments, Jurisdiction, Materials, Equipment, Personnel.
Identifiers: *Belgium, Preventive measures.

An overall plan for Belgium and other nations for the struggle against pollution of the sea by hydrocarbons is presented in outline form. The plan begins with surveillance, communication (alert system) and intervention. Preventive measures are discussed and a global system for sea and shore is a major part of the plan. Unity of decision within and among nations and industries as to jurisdiction and responsibility is emphasized. Materials, equipment and personnel are considered as to efficacy, availability, facility, cost and effects on the environment. Prospects for Belgium and for international cooperation in this plan are mentioned. (See also W71-13751) (Ensign-PAI)
W71-13776

THE PROBLEM OF THE POLLUTION OF COASTAL WATERS IN PORTUGAL,
Instituto Hidrografico, Lisbon (Portugal).
J. E. De Ataide.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 31.1-31.7.

Descriptors: *Water pollution control, *Legislation, *Coasts, *Oil, Pollution effects, Aquatic organisms, Public health, Pollution abatement.
Identifiers: *Portugal, Medical Oceanography Center, Conservation parks, Alarm systems.

Portugese legislation regarding marine pollution commenced in 1883. Comprehensive studies of naval and meteorological programs are being utilized now for the location of oil spills. Government ships and planes will be used in an alert system. Pollution control and combat center will be established, with authority being vested in the Harbor Master to control the mobilization of personnel and equipment in emergencies. Establishment of a Medical Oceanography Center to study the effects on human life and a national network of submarine parks are planned to preserve flora and fauna and research studies of decontamination. (See also W71-13751) (Ensign-PAI)
W71-13777

INTERNATIONAL COOPERATION,
Commission Interministerielle de la Politique Scientifique, Brussels (Belgium).
M. Renson.
In: N.A.T.O., Committee on the Challenges of Modern Society, Colloquium on Pollution of the Sea by Oil Spills, November 2-6, 1970, Brussels, Belgium, p 32.1-32.7.

Descriptors: *Water pollution control, *Oil wastes, *Cleaning, *International law, *Communication, Personnel, Equipment, Research facilities.
Identifiers: *International cooperation, Regional cooperation.

An international center for the collection and distribution of information regarding oil pollution should be established to avoid duplication in personnel, equipment and research costs. In dealing with spills regional cooperation should be instituted and a plan established which will prevent improvisation of cleaning up spills. Pollution accidents will continue to be distinctly different from each other and therefore the choice of means to handle them should be placed in the hands of authorized experts. (See also W71-13751) (Ensign-PAI)
W71-13778

UNITED STATES V. ESSO STANDARD OIL CO. OF PUERTO RICE (CRIMINAL PROSECUTION OF OIL COMPANY FOR VIOLATION OF RIVERS AND HARBORS ACT).
For primary bibliographic entry see Field 06E.
W71-13780

STATE V DUXBURY (CONSTITUTIONALITY OF LEGISLATION ESTABLISHING POLLUTION CONTROL AGENCY).
For primary bibliographic entry see Field 06E.
W71-13782

CITY OF SAN ANTONIO V. CDJ ENTERPRISES, INC (ISSUANCE OF EFFLUENT DISCHARGE PERMITS).
For primary bibliographic entry see Field 06E.
W71-13783

A NEW APPROACH TO CAGE WASTE DISPOSAL IN A CANINE LABORATORY,
Veterans Administraton Hospital, West Roxbury, Mass. General Medical Research Dept.
P. Godin, and J. Belko.
Laboratory Animal Care, Vol 18, No 3, June 1968. p 401-404, 2 fig, 2 ref.

Descriptors: *Waste disposal, *Animal parasite, Laboratory, Labor, Moisture content, Water pollution control, Equipment, *Pollution abatement.
Identifiers: *Automatic flush waste system, Dog cage wastes, Compactness, Flushing.

The need for the improvement of animal housing to meet future standards prompted the design of a new type of animal cage at the Veterans Administration Hospital. This particular dog cage system has been in use for 3 years, housing 25 animals in a small area, yet meeting all the requirements for good animal care. The cages are custom-installed prefabricated fiberglass, featuring a central drain that ties into existing public sewer lines. An automatic flush system connected to the drain lines reduces both odors and labor. The general condition of the dogs have improved, and the number of parasites diminished with the way of cleaning. The relative humidity rises to 57% in the first hour after cleaning, then maintains a level of 47-50% throughout the day. This system may readily be adopted to existing or new animal facilities. (Bundy-Iowa State)
W71-13784

AGRICULTURAL LAND DRAINAGE AND STREAM POLLUTION,
For primary bibliographic entry see Field 05B.
W71-13786

MANURE MITES IN INTEGRATED FLY CONTROL.

Poultry Digest, February 1971. p 68.

Descriptors: *Poultry, *Biocontrol, Mites, Farm waste, Larvae, Environmental effects, Population, Predation, Air temperature, Pollution abatement, California.
Identifiers: *Fly control, Mesostigmatid, Thinoseis spinosus, Fuscuropoda vegetans.

The manure mite is a biological control method in which a predator population eliminates a fly problem. Several species of mites have been found in California as being associated with the poultry industry. Some of the different mites being associated with flies on poultry ranches include Mesostigmatid mite, Thinoseis spinosus, and the Fuscuropoda vegetans. These mites do not get on people or birds, but they stay in the manure. They are most active in the winter, and can easily be seen on the surface of the manure when it cools off. The manure mite is a major predator on fly eggs. The manure mite in itself will not control flies, but can be used along with pesticides for control. (Bundy-Iowa State)
W71-13788

BEART V CITY OF ARVADA (LIABILITY OF CITY FOR DISCHARGING INADEQUATELY TREATED SEWAGE).

412 P.2d 902-905 (Colo 1966).

Descriptors: *Colorado, *Sewage, *Cities, *Water pollution, Legal aspects, Judicial decisions, Adjudication procedure, Water pollution sources, Water pollution effects, Water pollution control, Water quality, Water quality control, Treatment facilities, Sewage treatment, Sewage disposal, Streams, Sewage effluents, Waste water treatment, Municipal wastes, Odor, Water properties, Remedies.

Plaintiff mobile home park owner sought damages and injunctive relief against defendant municipality. Plaintiff's park was located downstream on a creek into which defendant discharged sewage. It was alleged that defendant negligently discharged raw and inadequately treated sewage into the crrek. Plaintiff properly filed notice of the injury as a condition precedent to filing suit. Defendant moved to dismiss the complaint for failure to state a cause of action, and the motion was granted. The Colorado Supreme Court, however, could not ascertain the reasons for which the complaint was dismissed. The court determined that the complaint stated alleged facts which would entitle plaintiff to relief if proven. It was also noted that the trial court had erred in taking judicial notice of defendant's sewage problem. Hence, the decision of the lower court was reversed. (Hart-Florida)
W71-13796

CITY OF MOORE V CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT (INJUNCTION TO PROHIBIT CITY FROM POLLUTING RESERVOIR).
For primary bibliographic entry see Field 06E.
W71-13799

FISHING REGULATIONS; LICENSING.
For primary bibliographic entry see Field 06E.
W71-13809

AUGUSTINE V HINNEN (LIABILITY OF OIL LESSEE FOR SALINE POLLUTION OF WATER SUPPLY ON ADJACENT LANDS).
For primary bibliographic entry see Field 06E.
W71-13816

STOCHASTIC MODELING FOR WATER QUALITY MANAGEMENT.
Stochastics, Inc., Blacksburg, Va.
For primary bibliographic entry see Field 05B.
W71-13824

REGULATION OF WATERCRAFT--SEWAGE DISPOSAL.
For primary bibliographic entry see Field 06E.
W71-13846

PEOPLE V CITY OF LOS ANGELES (SEWAGE DISPOSAL INTO BAY RESULTING IN POLLUTION OF SHORELINES).
For primary bibliographic entry see Field 06E.
W71-13857

CITIES SERVICE OIL CO V. MERRITT (DAMAGES FOR THE POLLUTION OF SUBTERRANEAN WATERS).
For primary bibliographic entry see Field 06E.
W71-13883

CONCEPTS OF POLICY IN THE FORMULATION OF SO-CALLED STANDARDS OF HEALTH AND SOCIETY,
For primary bibliographic entry see Field 05F.
W71-13887

STUDY OF SULFUR RECOVERY FROM COAL REFUSE,
Black, Sivalls and Bryson, Inc., Pittsburgh, Pa. Applied Technology Div.
Paul J. LaRosa, and H. James Michaels.
Copy available from GPO Sup Doc as SN-5501-0137, $0.70; microfiche from NTIS as PB-203 488, $0.95. Environmental Protection Agency, Water Quality Office Report, Sept 1971. 67 p, 20 fig, 6 tab, 5 ref. EPA Program 14010 FYY 09/71.

Descriptors: *Acid mine water, *Coal mine wastes, *Pollution abatement, Industrial wastes, Sulfur, Water pollution sources.
Identifiers: *Sulfur recovery, Ash pellets.

During coal preparation, a coal refuse of no commercial value is produced and discarded in piles. As rainfall percolates through the piles, acid waters are formed. A feasibility study has been performed on a process producing sulfur from such coal refuse. In this process, limestone and coal refuse are ground, pelletized, and preheated before entering a desulfurizing shaft reactor where a hard, fired ash pellet and an H2S-SO2 bearing offgas are produced. After sulfur, tar, and other gases are removed, the resulting H2S-SO2 gas proceeds to a conventional sulfur recovery plant. Experimental results and economics of this study indicate that the process is a profitable means of minimizing coal refuse pile water pollution. For a sulfur and ash pellet selling price of $20 and $1.50/ton respectively, it is estimated that a coal producer will have a before tax return on investment up to 53 percent for one MM ton/year plant utilizing an eight percent sulfur refuse.
W71-13895

RECOVERY OF OIL SPILLS USING VORTEX ASSISTED AIRLIFT SYSTEM,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
P. C. Walkup, J. D. Smith, and E. R. Simonson.
Copy available from GPO Sup Doc as SN-5501-0069, $0.50; microfiche from NTIS as PB-203 489, $0.95. EPA-Water Quality Office Report, July 1970. 40 p, 18 fig, 17 ref. EPA Program 15080DJM07/70.

Descriptors: *Research and development, *Water pollution, *Water pollution control, *Vortices, *Oily water, Pumping.
Identifiers: *Vortex, *Coanda, Oil spills, Airlift.

Studies were conducted to determine the feasibility of a concept for recovery of floating oil slicks which utilizes a pump induced vortex and a vacuum suction or Coanda nozzle. The apparatus used for developmental experimentation comprised a pumping system for vortex production, a large water basin, a flapper type wave generator, and several configurations of the experimental assembly. The range influence was smaller than was anticipated. Approximately a 25-foot influence of diameter was achieved for the maximum strength vortex generated in this apparatus. Extrapolation of measured performance data showed that a 1/8-inch thick slick could be recovered at the rate of 960 gallons per hour. Experiments with and without a variety of oils showed that enhanced oil recovery rates with the vortex was due entirely to the surface current generated by the vortex. This effect was found to improve oil recovery by a factor 7.9 above the rates achieved with a suction nozzle alone. The surface position of the vortex cavity was found to be sensitive to surface waves. The cavity moved in a circular path within three vortex cavity radii of the still water cavity location as a wave passed through the assembly. Tests with a Coanda nozzle (a fluid attachment educator) showed improved performance in surface waves. However, the recovered oil-water mixture was highly emulsified.
W71-13896

CONCEPT DEVELOPMENT OF A HYDRAULIC SKIMMER SYSTEM FOR RECOVERY OF FLOATING OIL,
Battelle Memorial Institute, Richland Wash. Pacific Northwest Labs.
John R. Blacklaw, Blaine A. Crea, E. Roger Simonson, and Paul C. Walkup.
Copy available from GPO Sup Doc as EP 2.10: 15080 FWP 04/71, $1.25; microfiche from NTIS as PB-203 498, $0.95. Water Quality Office, Program Number 15080 FWP 4/71, April 1, 1971. 88 p. EPA Program 15080 FWP 04/71.

Descriptors: *Evaluation, *Oily water, *Separation techniques, *Technical feasibility, Efficiencies, Hydraulic systems, Hydrodynamics, Jets, Mathematical studies, Testing, Water pollution treatment, Oceans, Equipment.
Identifiers: Oil skimmer.

Efforts are being directed to develop effective countermeasures against floating oil slicks. Mechanical recovery methods, which do not cause additional environmental insult, are most attractive. Such a concept, a hydraulic skimmer, was investigated. Floating headers, providing a linear water spray pattern on the water surface, are attached to an open sea workboat. Sea water is pumped through spray nozzles mounted on the headers to move an oil slick toward the boat. Side mounted chambers are positioned to collect the concentrated floating oil. Recovered fluid is pumped to an onboard separation system from which the oil is transferred to floating tanks or barges and the water is recycled to the spray system. Experimental work was directed toward component development and evaluation of a large system model in a simulated environment. A 35-foot support vessel, a 40-foot spray header, and a 9-foot collection chamber provided the 23 1/2-foot model sweep width. Speeds of advance to five knots, random waves to 30 inches significant height and three oil types were used in evaluating this system. Other equipment such as an ultrasonic oil thickness gauge, process pumps and tankage were also used. Model experiment results showed, for light oils, 80 to 100 percent effectiveness and oil recovery rates of 6600 to 8700 gph. Results with Bunker fuel were not as good, being on the order of 1300 to 1800 gph and 12 to 30 percent effective in recovering oil from the water surface. However, program time constraints did not permit experimental verification of modifications expected to increase performance on heavy oils. Further development of the concept, including additional model testing with heavy oils plus open sea evaluation of a prototype system was recommended.
W71-13897

CITY OF TACOMA V WELCKER (EMINENT DOMAIN ACTION TO PREVENT POLLUTION OF MUNICIPAL WATER SUPPLY).
For primary bibliographic entry see Field 06E.
W71-13905

ENGLE V. CITY OF OROVILLE (ABATED NUISANCE IS NO LONGER BASIS FOR INJUNCTION).
For primary bibliographic entry see Field 06E.
W71-13914

GARLAND GRAIN CO V D-C HOME OWNERS IMPROVEMENT ASS'N (INJUNCTION TO ABATE A NUISANCE FROM POSSIBLE POLLUTION).
For primary bibliographic entry see Field 06E.
W71-13946

DRAINAGE DISTRICTS-POLLUTION CONTROL.
For primary bibliographic entry see Field 06E.
W71-13950

COMMITTEE REPORT ON PUBLIC LAW 91-172.
For primary bibliographic entry see Field 06E.
W71-13952

HOW MANY INDIVIDUAL WELLS ARE CONTAMINATED.
Ground Water Resources Inst., Chicago, Ill.
For primary bibliographic entry see Field 05B.
W71-13967

WATER QUALITY SIMULATION MODEL,
Camp, Dresser and McKee, Boston, Mass.
For primary bibliographic entry see Field 05B.
W71-13978

WATER QUALITY MANAGEMENT METHODOLOGY AND ITS APPLICATION TO THE SAINT JOHN RIVER, (Appendix H).
Department of Environment, Ottawa (Ontario). Directorate of Policy Planning.
For primary bibliographic entry see Field 05B.
W71-13980

WATER QUALITY MODELS, (Appendix A).
Department of Environment, Ottawa (Ontario). Directorate of Policy Planning.
For primary bibliographic entry see Field 05B.
W71-13981

GASES AND ODORS FROM POULTRY MANURE: A SELECTED BIBLIOGRAPHY,
Merck and Co., Rahway, N.J. Quinton Research Labs.
For primary bibliographic entry see Field 05B.
W71-13987

TRI-STATE COMPACT AND INTERSTATE SANITATION COMMISSION.
For primary bibliographic entry see Field 06E.
W71-13996

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

THE APPLICATION OF THE DSDT HYBRID COMPUTER METHOD TO WATER RESOURCES PROBLEMS,
California Univ., Los Angeles. School of Engineering and Applied Science.
W. J. Karplus and J. A. Dracup.
California Water Resources Center, Los Angeles, Completion Report, UCLA-ENG-7142, June 1971. 13 p, 1 fig, 19 ref, 6 append. OWRR A-032-CAL (4).

Descriptors: *Computer models, *Digital computers, *Resistance networks, *Simulation analysis, *Water resources, *Flow, Distribution systems, Groundwater basins, Aquifers, Data processing.
Identifiers: *DSDT, San Fernando Valley Basin.

The applicability is reported of the DSDT hybrid computer techniques to the simulation of water resources systems and the solution of hydrology problems. The research objective was to investigate the feasibility of applying the DSDT method involving the use of an analog subroutine in a closed loop with a digital computer to the treatment of fluid flow. Previous and current studies using the DSDT technique were reviewed. The DSDT method was initially tested on the San Fernando Valley Basin. Six published papers dealing with the DSDT

method were reproduced in the report. The authors demonstrated that various hydrology problems can be treated successfully using the analog subroutine approach. Small-scale simulations of aquifers will be continued in the future but attention will shift to the area of modeling and identification. Research is now underway to develop algorithms and program packages for processing raw field data since that is a major obstacle to the development of successful and dependable models of water resources systems. (Markell-Cornell)
W71-13151

THE EXISTING STATUS OF WATER MANAGEMENT,
S. Sussna.
Journal of Environmental Systems, Vol 1, No 2, p 183-188, June 1971.

Descriptors: *Water management, *Water resources planning act, *Federal jurisdiction, *New Jersey, *Controlled drainage, Streamflow, Height, Velocity, Riparian rights, Navigable waters, Submerged lands act.

The lack of watercourse management responsibilities imposed upon individuals or public bodies was discussed and the diffuseness of responsibility embodied in legislation, particularly in New Jersey, was examined. Methods were described in which governmental action could establish regulations concerning drainage outlets and watercourses that traverse private property. The most direct method is through acquisition of easements or by acquiring title to lands, either with the consent of the property owners affected or by condemnation. Watercourse regulation involves controlling and preventing obstruction of drainage ways to facilitate safe disposal of water and the control of streamflow so that height and velocity of morning water do not overburden drainage facilities or result in flood damage. The enactment of stream encroachment laws would be one means of achieving this objective. The author concluded that effective water control is dependent on public action. (Markell-Cornell)
W71-13211

SYSTEMS ANALYSIS FOR URBAN WATER SUPPLY AND DISTRIBUTION,
Parsons, Brinckerhoff, Quade and Douglas, New York. Advanced Technology Div.
G. M. Sturman.
Journal of Environmental Systems, Vol 1, No 1, p 67-76, March 1971. 9 ref.

Descriptors: *Water supply, *Distribution, *Simulation analysis, *Operations research, *Hydraulic engineering, *City planning, *Financial analysis, *Optimization, *Total costs, Water demand, Computer programs.

A comprehensive approach to the development of water supply and distribution system that would meet all probable water demands at minimum total cost involving the use of systems analysis, computer-aided land-use planning and engineering, and a multidisciplinary team of urban planners, hydraulic engineers and financial specialists was discussed. Interaction and input between each technical discipline was emphasized if rational, comprehensive decisions were to be made. Several systems analysis methods were reviewed. Recent advancements in systems analysis methodology, planning, operations research and hydraulics provide solution techniques as well as computer programs for a wide variety of water resource problems. The total planning process consists of: (a) determination of demand; (b) conceptual development of alternative systems; (c) optimization of the selected system; and (d) development of a design, construction, and financial plan for the selected optimum system. (Markell-Cornell)
W71-13212

SYSTEMS ENGINEERING AND WATER RESOURCES IN SOUTHERN NEVADA,
Nevada Univ., Reno. Center for Water Resources Research.
G. F. Cochran.
Water Resources Bulletin, Vol 7, No 4, p 689-699, August 1971. 7 fig, 9 ref.

Descriptors: *Conjunctive use, *Systems analysis, *Water management, *Groundwater, *Surface water, *Dynamic programming, *Optimization, *Sequential decision making, Institutional constraints, Water laws, Resource utilization.
Identifiers: *Las Vegas Valley.

A conjunctive use model for water resource management was constructed of the Las Vegas Valley in southern Nevada for a projected period of 50 years. The objectives of the study were: (1) development of a model to determine the optimal conjunctive use policy under existing legal, economic and physical constraints; (2) analysis of existing managerial and administrative water agencies and water laws; (3) analysis of area economy and population, and development of a range of possible futures; (4) determination of public attitudes toward local water problems of quantity and quality and willingness to pay for various levels of quality; (5) evaluation of the effects, by use of the model, of legal, administrative and economic constraints on optimal conjunctive use; (6) determination of optimal water uses and water price schedules; (7) development of an optimal administrative and managerial water management scheme; and (8) development of an over-all optimal conjunctive use policy. Dynamic programming was used to determine the sequence of resource utilization that minimized the present value of operating costs over the 50 year planning horizon. (Markell-Cornell)
W71-13213

OPTIMIZATION OF WATER ALLOCATION DECISIONS AFFECTING ESTUARINE ECOLOGY,
Colorado School of Mines, Golden. Dept. of Mathematics.
H. S. Swanson, C. S. Beightler, and D. T. Phillips.
Water Resources Bulletin, Vol 7, No 4, p 708-716, August 1971. 1 fig, 20 ref.

Descriptors: *Optimization, *Water allocation, *Surface water, *Estuaries, *Operations research, *Cost-Benefit analysis, Circulation, Coastal plains, Ecology.
Identifiers: Out-of-Kilter algorithm, Sensitivity analysis, Input data.

The objective was to maximize the total net economic benefit resulting from the allocation of surface water in a river system to those who compete for its use. It was recognized explicitly that for coastal states, the ecology of bays and estuaries, were also competitors. Benefit was defined as a function of the amount of water used and the time during which water was used. The solution technique used was Fulkerson's Out-of-Kilter optimization algorithm. The algorithm solved the minimum cost circulation network flow problem and provided a quantitative technique for evaluation of alternative water uses. The minimum economic benefit required to justify the allocation of a given volume of water needed to sustain an estuary's ecology was estimated using sensitivity analysis on the input data. (Markell-Cornell)
W71-13215

SOME CONJUNCTIVE DESALTING STUDIES IN THE UNITED KINGDOM,
Water Research Association, Marlow (England). Economics Group.
P. A. Mawer, J. O. Philip, J. D. F. Sherrif, T. Wyatt, and J. D. Barrett.
Water Resources Bulletin, Vol 7, No 4, p 831-843, August 1971. 10 fig, 5 tab, 7 ref.

Descriptors: *Conjunctive use, *Desalination, *Dynamic programming, *Water resources, *Water demand, *Economic justification, Optimization, Systems analysis, Mathematical models, Optimum development plans.
Identifiers: *Operating rule, *Search techniques, Barcelona, Spain.

The study's objective was to minimize the cost of meeting a given water demand at some specified degree of reliability from a defined conventional surface water resource system operated in conjunction with a desalting plant of given capacity through optimal operating rule procedures. The operating rules took the form of a set of critical reservoir levels. Two alternative approaches were explored for the optimization of the critical levels: direct search techniques of the hill-climbing type and value iteration dynamic programming. Although the hill-climber was marginally superior in terms of the load-factor, both procedures produced similar results. Specific site feasibility studies, e.g. Barcelona area of Spain showed the large economic benefits of the proper use of conjunctive desalting. Further, the operating rule procedures described have immediate application to the optimization of surface/groundwater systems. (Markell-Cornell)
W71-13217

A MULTI-BASIN PLANNING STRATEGY,
Texas State Water Development Board, Austin. Systems Engineering Div.
A. O. Weiss, and L. R. Beard.
Water Resources Bulletin, Vol 7, No 4, p 750-764, August 1971. 9 fig, 8 ref.

Descriptors: *Optimization, *Optimum development plans, *Simulation analysis, *Basins, *Risks, *Water demand, *Unit costs, *Uncertainty, *Total costs, Capital costs, Operational costs, Computer programs, Canals, Reservoirs.
Identifiers: Texas Water System.

An optimal staging plan was presented and partially tested for implementing a multi-basin water resouce system such as the proposed Texas Water System. The strategy presented water resource development plans to satisfy a set of prespecified goals at minimum total cost, while also seeking to find plans that would reduce the impact of risk and uncertainty given a prespecified supply, a prespecified increasing water demand and unit penalty costs for failure to meet those demands. The specific objective was to determine: (a) which of an over-specified set of facilities should be constructed; (b) how large each of the facilities should be at various points on the demand build-up curve; and (c) how the resulting optimized system of canals and reservoirs should be operated both during and after the period in which facilities are being added or increased in size.The planning strategy included optimization, trend analysis techniques, fill-in programs, stochastic data generation programs, flow refinement, projection techniques, and optimum development plans. The solution technique used various computer programs such as SIMYLD-I, SIM-III and the CAPEX-I. (Markell-Cornell)
W71-13218

A COMPUTER SIMULATION PROGRAM FOR OPTIMIZING CONJUNCTIVE OPERATION OF DESALTING PLANTS,
Hill (Clair A.) and Associates, Redding, Calif.
W. H. Blood, C. G. Clyde, and D. F. Peterson, Jr.
Water Resources Bulletin, Vol 7, No 4, p 785-801, August 1971. 7 fig, 3 tab, 3 ref.

Descriptors: *Optimization, *Conjunctive use, *Simulation analysis, *Desalination plants, *Water resources, *Water yield, *Unit costs, Computer programs, Reservoir construction, California, New York, Utah.
Identifiers: Operating rule program.

With the shortage of natural water resources, desalting plants can provide a 'firm yield' when

operating in conjunction with existing water supply reservoir systems. Natural inflow is variable, thus a method was proposed for determining when to run the desalting plants to meet a given demand. The criteria for defining the firm water yield of the system (with and without desalting) were defined. To find the optimal operating rule, a computer program written in FORTRAN IV successively simulated the operation of the given size reservoir-desalting plant system under control of various operating rules and selected as optimal one which produced the required firm water yield at the least unit cost. The optimal plant size and the construction staging were computed and analyzed. The operating rule program as applied to water systems in California, Utah and New York was described. Compared with base load operation, the studies showed that substantial savings were possible with optimum intermittent conjunctive operation of the desalting plant. (Markell-Cornell)
W71-13219

CONJUNCTIVE USE OF SEA AND FRESH WATER RESOURCES: AN INTEGER PROGRAMMING APPROACH,
California Univ., Los Angeles. Dept. of Systems.
F. Mobasheri, V. S. Budhraja, and F. E. Mack.
Water Resources Bulletin, Vol 7, No 4, p 823-830, August 1971. 1 fig, 11 ref.

Descriptors: *Conjunctive use, *Reservoir storage, *Desalination plants, *Optimization, *Operations research, *Water demand, *Water resources, Dynamic programming, Mathematical models.
Identifiers: *Implicit enumeration.

Mathematical models were formulated for selection of least cost water resources projects to meet the future water demands of a region. Alternative projects considered in this analysis included surface storage reservoirs and desalination plants. Integer programming was used to determine the optimum size and sequential development of water resources projects using an implicit enumeration technique. Planning time horizon and discount rate decisions were considered exogenous variables. The IBM 360/90 computer was used. To postpone construction of capital intensive surface reservoir projects, the hypothesis that large desalination projects would become economical when used as an interim supply source was also tested. The results showed substantial cost savings with the development of desalination projects with 10 years active economic life. (Markell-Cornell)
W71-13220

SHORELANDS PROTECTION AND MANAGEMENT ACT OF 1970.
For primary bibliographic entry see Field 06E.
W71-13221

USE OF MONTE CARLO TECHNIQUES IN THE DESIGN AND OPERATION OF A MULTIPURPOSE RESERVOIR SYSTEM,
California Univ., Los Angeles. School of Engineering and Applied Science.
A. J. Askew, W. W. G. Yeh, and W. A. Hall.
Water Resources Research, Vol 7, No 4, p 819-826, August 1971. 2 fig, 1 tab, 11 ref.

Descriptors: *Monte Carlo method, *Multiple-purpose reservoirs, *Probability, *Reservoir design, *Reservoir yield, *Optimum development plans, Mathematical models, Streamflow, Constraints, Digital computer.
Identifiers: *Shasta Dam, *Beard, Brute force.

Monte Carlo techniques were used to derive the optimum contract levels for a multipurpose system subject to constraints imposed by stated maximum permissible probabilities of failure to meet firm contract deliveries. Because the probability of failure associated with output objectives is often ignored, the authors suggest that most programming techniques may prove inefficient. A mathematical simulation of the Shasta Dam illustrated the Monte Carlo method. Streamflow records were generated by using the Beard technique. Incorporating the probabilities of failure associated with the various states of the system provides information, permits assessment of the comparative merits of various release rules, allows a benefit-cost study to determine the optimum operating policy as well as the optimum design and contract levels. The most important attribute of the Monte Carlo analysis is that it is simple to implement and understand and could be used to analyze single purpose, multireservoir or multipurpose, multireservoir systems without fundamental alteration to the procedure. (Markell-Cornell)
W71-13224

SPATIAL ALLOCATION MODEL FOR PROJECTED WATER BASED RECREATION DEMAND,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Economics.
M. E. Tadros, and R. J. Kalter.
Water Resources Research, Vol 7, No 4, p 798-811, August 1971. 2 tab, 18 ref.

Descriptors: *Spatial distribution, *Recreation demand, *Water demand, *Linear programming, *Digital computer, *Water allocation (Policy), *Forecasting, *Simulation analysis, New York, Estimating, Costs-benefit analysis.
Identifiers: *Iteration, LUNR.

An allocation model designed to distribute spatially projected recreation use estimates forthcoming from 'structural demand' equations of the recreation market for specified water based activities was presented. A linear programming model that handles simultaneously projected demand by occasion type, capacities of potentially visited recreation zones, time, distance and cost considerations was utilized. Application of the model to 22 counties in central upstate New York provided empirical results. Swimming, boating, fishing and camping were the four recreational activities for which the model was solved. Model solutions were obtained through use of the Fortran IV computer program and the IBM 360 Mathematical Programming System on the IBM 360/65 digital computer. Compatibility between results and the recreation demand projections used were ensured by model constraints and an objective function was postulated that permitted quality considerations to be incorporated into the model solution. Also, the model's simulation of policy actions through iteration techniques provide an important tool for decision makers and, although data requirements for empirical implementation are high, the model mechanism permits integration of various types of information and supplies a previously unavailable result. (Markell-Cornell)
W71-13225

OPTIMAL INTRASEASONAL IRRIGATION WATER ALLOCATION,
Montana State Univ., Bozeman. Dept. of Economics and Agricultural Economics.
N. J. Dudley, D. T. Howell, and W. F. Musgrave.
Water Resources Research, Vol 7, No 4, p 770-789, August 1971. 7 fig, 3 tab, 14 ref.

Descriptors: *Optimum development plans, *Irrigation programs, *Water allocation (Policy), *Computer models, *Risks, *Dynamic programming, *Soil-water-plant relationships, Simulation analysis, Climatic data.
Identifiers: *Bellman.

A plant growth-soil moisture simulation model was incorporated into a two state variable stochastic dynamic programming model to determine the optimal intraseasonal allocation pattern for irrigation water in an uncertain environment. The decision variable used in the dynamic programming model was the level of available soil water content before irrigation. The two state variables were soil water content and irrigation reservoir level per acre of irrigated crop. Historical traces of climatic data were used. Several earlier models were discussed. This study's unique feature was its incorporation of environment uncertainty in its approach to the problem of optimal allocation of a fixed water supply over the irrigation season. Given the initial assumed relationships within the model, the study results suggest that an irrigator should maintain available soil moisture in the root zone at a high level, even if it means early exhaustion of the water supply. The limitations and assumptions of the soil moisture-plant growth model and the dynamic programming model were explicitly recognized. (Markell-Cornell)
W71-13226

POLLUTION CHARGES INCOME AND THE COSTS OF WATER QUALITY MANAGEMENT,
Ohio State Univ., Columbus. Dept. of Economics.
For primary bibliographic entry see Field 05G.
W71-13227

MODEL DEVELOPMENT AND SYSTEMS ANALYSIS OF THE YAKIMA RIVER BASIN.
Washington State Research Center, Pullman.

Progress Report, (1970), 6 p. OWRR B-036-WASH (1).

Descriptors: *Computer models, *Dynamic programming, *Simulation analysis, *Data processing, *Statistics, *Water resources development, Streamflow, Drainage, Watersheds, Water quality control, Consumptive use, Irrigation, Soil-water-plant relationships, Economics.
Identifiers: *Yakima River Basin, *Snohomish River, Kittitas Valley.

This paper reported on the progress of Project No. B-036-WASH. Various new and previously existing models were adapted to the Yakima River Basin. A dynamic flow model was designed for the IBM system 360-67 computer to generate streamflow rate, and compute associated flow depth, velocity and stream surface area. A water quality model of the Snohomish River was adapted to simulate water quality, responses to several parametric changes including economic growth rate, treatment plant policies, stream waste water discharge locations, temperature and salinity. Basic descriptive information on present irrigations in the Yakima Valley was collected and a model was employed to estimate diversions, return flows and consumptive use on the Kittitas Valley. A stream survey was undertaken and a model for estimating required low flows to support fishery was developed to determine first round estimates of minimum flows at key points. To generate in-flows for the 5 major reservoirs and the major ungaged streams of the basin, a hydrologic model was completed. A descriptive, economic input-output model was developed for the Basin economy and was extended to form a functional, predictive model. The various computer models were compared and integrated by a central computer 'service.' (Markell-Cornell)
W71-13228

APPLICATIONS OF THE HORTON STREAM CLASSIFICATION TO EVALUATE FAUNAL STUDIES,
Kentucky Univ., Lexington. Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W71-13269

MODELS OF AQUATIC ENVIRONMENT BIOASSAY,
Aquatic Sciences, Inc., Boca Raton, Fla.
For primary bibliographic entry see Field 05C.
W71-13271

SYNTHETIC STREAMFLOWS,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 02A.
W71-13289

STORM WATER MANAGEMENT MODEL,
Metcalf and Eddy, Inc., Palo Alto, Calif., and Florida Univ., Gainesville. Dept. of Environmental Engineering; and Water Resources Engineers, Inc., Walnut Creek, Calif.
For primary bibliographic entry see Field 05D.
W71-13370

PREDICTION ERROR OF REGRESSION ESTIMATES OF STREAMFLOW CHARACTERISTICS AT UNGAGED SITES,
Geological Survey, Arlington, Va.
For primary bibliographic entry see Field 02E.
W71-13454

A STUDY TO DEVELOP A PROTOTYPE EMERGENCY WATER SUPPLY PLAN: METROPOLITAN WATER SYSTEM OPERATION SUBSEQUENT TO NUCLEAR ATTACK OR NATURAL DISASTER,
Texas State Water Utilities Dept., Dallas.
For primary bibliographic entry see Field 08C.
W71-13560

WATER QUALITY ANALYSIS FOR THE NEW YORK HARBOR COMPLEX,
Manhattan Coll., Bronx, N.Y. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W71-13630

APPLICATION OF STATISTICAL DECISION THEORY TO GREAT LAKES MANAGEMENT,
Raytheon Co., Marine Research Lab, New London, Conn.
Stanley G. Chamberlain.
International Association Great Lakes Research, Proceedings 13th Conference Great Lakes Research, p 145-148, 1970. 1 fig, 1 tab, 4 ref.

Descriptors: *Water quality control, *Decision making, *Statistical models, *Methodology, Risks, Value engineering, Costs, Probability, Great Lakes.
Identifiers: *Statistical decision theory, Value theory, Utility theory.

Effective management of natural resources such as the Great Lakes Basin produces decisions that minimize objectives at minimum cost. Such optimization, however, must overcome the complexities and uncertainties intrinsic to all large natural resources. Statistical Decision Theory (SDT), also called 'Value' or 'Utility Theory', provides a methodology for combining the pertinent complexities and uncertainties so that the consequences of alternative decisions become clear. In SDT, a decision tree displays the paths from given states of nature to consequences of alternative decisions; probabilities are assigned to uncertainties in the states, paths, and consequences. Utility values are attached to each potential action and consequences to quantify costs and benefits; actions maximizing expected utility are then chosen as optimal. To illustrate SDT, a simplified example of industrial pollution in the Great Lakes Basin is given. Reasonable costs and probabilities are associated with four potential actions: (1) build an efficient treatment plant, (2) research and develop a secondary processor, (3) stock the lakes with robust species, (4) or do nothing. Possible consequences of these actions are defined and utilities associated with them. Expected utility functions for each action are found, and the resulting maximization determined when each action would be optimal. (Settle-Wisconsin)
W71-13654

EROS AS A TOOL IN COASTAL ZONE MANAGEMENT,
Department of Natural Resources, Washington, D.C. Surveys and Marine Management Div.
For primary bibliographic entry see Field 07B.
W71-13727

A NOTE ON THE FIRST EMPTINESS TIME OF AN INFINITE RESERVOIR WITH INPUTS FORMING A MARKOV CHAIN,
Carnegie-Mellon Univ., Pittsburgh, Pa.
J. P. Lehoczky.
Journal of Applied Probability, Vol 8, No 2, p 276-284, June 1971. 1 fig, 11 ref.

Descriptors: *Markov processes, *Reservoir storage, *Computer models, *Distribution, *Time series analysis, Discharge (Water), Mathematics, Stochastic processes.
Identifiers: Traffic flow.

In storage theory, the behavior of an infinite reservoir when the input process forms a stationary Markov chain is of current interest. Recent investigation of the time dependent behavior of the reservoir includes a derivation of the exact distribution of the first emptiness time of the reservoir. This paper presented a new derivation of the exact distribution of the first emptiness time. The derivation uses concepts developed for the calculation of this distribution under stationary independent input conditions. Generating functions and latent roots of the transition probability matrix were avoided. A method which emphasized the close relationship between the stationary Markov chain input and the stationary independent input exactly computed the moments of the first emptiness distribution. The first moment of the area beneath the sample path was calculated. This area is often used as a measure of total delay in traffic flow theory. Similar methods can compute higher moments of the area beneath the sample path. (Markell-Cornell)
W71-13779

FLOOD FREQUENCY ESTIMATING TECHNIQUES FOR SMALL WATERSHEDS,
Hydrocomp International, Palo Alto, Calif.
G. Fleming, and D. D. Frantz.
Journal of the Hydraulics Division, ASCE, Vol 97, No HY 9, p 1441-1460, September 1971. 3 fig, 2 tab, 35 ref.

Descriptors: *Simulation analysis, *Digital computers, *Floods, *Frequency analysis, *Estimating, *Small watersheds, Hydrologic cycle, Statistics, Mathematical models, Input-Output analysis.
Identifiers: *Hydrocomp Simulation Program, Stanford Watershed Model, Potter's statistical procedures, Rational method, Eastern United States.

The objective was to find a hydrologic method which would define the flood frequency characteristics of streams of less than 20 square mile drainage area. Available methods were reviewed. Four techniques, e.g. simulation with Hydrocomp Simulation Program, Regional frequency analysis, Potter's method and Rational method were tested and compared on 11 small watersheds with records of 15-20 years. For the streams tested, the results showed that the Hydrocomp Simulation Program reproduced flood frequency curves which most closely fit the observed flood frequency curve. It was suggested that an investigaition of the areal extent of thunderstorms with a view to appropriate modification of rainfall inputs to simulation may lead to improved simulation results. Basic problems involved in frequency analysis of short flow records on small streams were reaffirmed and further research for resolution of these problems was recommended. A proposal was also made that digital simulation be adapted to the derivation of design flows for highway culverts. (Markell-Cornell)
W71-13781

STOCHASTIC MODELING FOR WATER QUALITY MANAGEMENT.
Stochastics, Inc., Blacksburg, Va.
For primary bibliographic entry see Field 05B.
W71-13824

A RIVER, A REGION, AND A RESEARCH PROBLEM,
Washington Univ., St. Louis, Mo. Inst. for Urban and Regional Studies.
For primary bibliographic entry see Field 06B.
W71-13902

A COMPUTER PROGRAM FOR SEWER DESIGN AND COST ESTIMATION,
Regional Planning Council, Baltimore, Md.
P. L. Zepp and A. Leary.
April 1969. 83 p, 9 fig, 5 tab, 8 ref, 5 append. HUD No. P-71.

Descriptors: *Programming language, *Computer programs, *Sewers, *Estimated costs, *Design criteria, Comparative costs, Pumping plants, Manholes, Pipe flow.
Identifiers: *Fortran, Gravity pipe, Pipe sizes, Pipe slopes.

The need for a faster and more economical method of cost analysis and design of a sanitary sewer system is satisfied by using a computer program. The Design Model Program is written in the General Electric Time-Sharing Fortran Language for use on the G. E. Model 235 computer, using paper type and teletype input and output. Digital input to the program consists of the area tributary to each pipe for each land use type, pipe length, and ground elevation at each manhole. The model is composed of three separate programs linked together and run sequentially. The first calculates sewage flows and makes assignments to various pipes. The second calculates pipe sizes, invert elevations at manholes, pipe grades, and optimum pipe costs. A subroutine calculates total costs, including the pumping station. By comparing several pairs of system costs, the most economical system (e.g., gravity pipe vs. pumping station design) can be selected. The third program prints the results. The output consists of peak sewage flows, pipe sizes, elevations of pipe inverts at manholes, pipe slopes, costs of pipes per foot between manholes, total costs of pipes between manholes, and total system costs. (Haugh-Wisconsin)
W71-13942

COMPUTER METHODOLOGY AND WATER RESOURCE DEVELOPMENT,
Metcalf and Eddy, Inc., Boston, Mass.
S. L. Bishop, and J. P. Vittands.
Journal of American Water Works Association, Vol 63, No 9, p 589-595, September 1971. 5 fig, 3 tab, 1 ref.

Descriptors: *Computer models, *Hydrology, *Hydrologic equations, *Reservoir storage, *River basins, *Simulation analysis, *Natural flow, Water supply, Input-output analysis, Gaging stations, Surface runoff, Yield equations, *Hudson River.
Identifiers: *Housatonic River basin, Schematic, Iteration.

Over 100 separate water-supply projects were investigated, of which over 40 were analyzed by computer simulation. Comprehensive computer programs for hydrologic analysis of river systems and river basins allow analysis of many alternative reservoir development plans. This project specifically outlined the approaches used and the computer techniques employed in analyzing the hydrologic capability of systems of reservoirs, in particular the Hudson and Housatonic river basins. Historic streamflow data were used to determine the hydrologic capability of each reservoir's development plan. Selected gaging station records were multiplied by a factor in order to account for different-sized drainage areas. A factor close to unity was desired. Empirical evaluation of this approach was achieved by comparing selected gaging station data. Hydrologic equations were prepared describing water runoff to each section of the basin. Computer simulation checked and determined the hydrologic capability of the alternative development plans on an overall river-basin basis and schematic models of each basin were prepared.

An iterative procedure was used to ascertain the basin yield of the reservoir system-analysis computer program. Various water demands were satisfied on the basis of an upstream-to-downstream order at control points. (Markell-Cornell)
W71-13974

SYSTEMS ENGINEERING FOR URBAN UTILITIES,
Parsons, Brinckerhoff, Quade, and Douglas, New York. Advanced Technology Div.
G. Sturman, P. H. Gilbert, and J. P. Wolfner.
Journal of the American Water Works Association, Vol 63, No 9, p 564-570, September 1971. 5 fig, 6 ref.

Descriptors: *Optimum development plans, *Simulation analysis, *Digital computers, *Linear programming, *Mathematical models, *Water demand, *Water supply, *Distribution systems, Land use, Input-output analysis, Urbanization, Ohio.
Identifiers: *Dynamic Land Use Model, *Cleveland (Ohio).

This study reported on an 18-month study of the water-supply and distribution system of the city of Cleveland. The study's objectives were: (1) development of a physical and financial expansion for Cleveland's water-supply and distribution system, phased through 1990 and 2010; (2) provision of a basis for systematically continuing plans and reevaluations in the process of managing the expansion of the water-supply and distribution system; (3) advancement of plan and design methodologies through the utilization of systems-engineering and systems-analysis techniques to aid in analyzing all feasible alternatives and to identify optimal solutions; and (4) exploration and evaluation of the potential effect of water availability on regional activity and development patterns. Achievement of the objectives involved development of DYLAM, a computer system which provided water-demand criteria and demand distribution plots; construction of a hydraulic model which analyzed data thus permitting determination of the maximum-day demand to average-annual demand and the peak hour/maximum day ratio; evaluation of the improved hydraulic system by using the same flow conditions extant in the existing network; development of an optimal (least cost) solution for a looped network of water mains through linear programming. The hydraulic analysis was completed on the IBM 360/85 computer. (Markell-Cornell)
W71-13975

SYSTEMS APPROACH AND THE CIVIL ENGINEER,
Purdue Univ., Lafayette, Ind. Dept. of Civil Engineering.
K. W. Heathington, and R. B. Bunton.
Journal of Professional Activities, Vol 97, No PP1, p 65-82, October 1971. 25 ref.

Descriptors: *Systems analysis, *Operations research, *Civil engineering, *Social needs, *Risks, Estimating, Linear programming, Decision making.

Some of the limitations and advantages of the systems approach as it applies to civil engineering were explored and examined. Systems analysis uses whatever analytical techniques appropriate for decision making in the face of uncertainties to solve complex engineering, social, economic and political problems, e.g., national defense, welfare, health, education, crime, urban renewal, transportation, housing and environmental problems. All alternative courses of action are examined and the consequences of each are identified and evaluated. Systems teams must be truly interdisciplinary. Problems are approached horizontally allowing maximum inter-communication between decision makers and extensive exploration of the problem in question. Limitations within the systems approach include the financial and time factor, application of judgment and intuition, uncertainty, inadequate analysis of interactions between subsystems, excessive reliance on linearity in systems theory and models when actual behavior is highly complex and non-linear, lack of procedures to handle non-quantifiable parameters and a scarcity of professional systems analysts. Universities are now offering systems programs and it was suggested that new developments in technological forecasting should be promoted. (Markell-Cornell)
W71-13976

WATER RESOURCES PLANNING MODEL, (A Technical Note),
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Building Research.
J. F. Brotchie.
Journal of the Hydraulics Division, ASCE, Vol 97, No HY 10, p 1801-1806, October 1971. 2 fig, 5 ref.

Descriptors: *Resource allocation, *Water resources, *Optimum development plans, *Linear programming, *Cost-benefit ratio, *Computer models, Planning, Mathematical models, Water supply, Irrigation efficiency.

The problem of optimally planning a water resources system was proposed along with various solution techniques. The problem was defined as the allocation of total required water storage among the potential storage sites, the allocation of power generation among potential sites for these, the selection of the land needed for irrigation and the selection of the sequence and times of development of each so as to maximize the total benefits less costs of establishing and operating the activities on their sites plus the benefits less costs of interactions including flows between activities along paths between the zones. The constraint equation stated that all needs should be met in each planning period. The problem was put in linear form for which efficient algorithms for solution are generally available. Solution could be improved through iteration procedures. The computer program, TOPAZ, housed within a CDC 6600 computer system was used. An example illustrated the typical data required for the model and its possible uses. (Markell-Cornell)
W71-13977

OPTIMIZATION IN DESIGN OF HYDRAULIC NETWORK, (A Discussion),
Johns Hopkins Univ., Baltimore, Md. Dept. of Environmental Engineering.
J. C. Liebman, and E. D. Brill, Jr.
Journal of the Sanitary Engineering Division, ASCE, Vol 97, No SA5, p 786-792, October 1971. 2 fig, 4 tab.

Descriptors: *Optimum development plans, *Hydraulic design, *Network design, *Economic efficiency, *Yield equations, Mathematical studies, Operations research, Cost-benefit analysis.
Identifiers: Lagrange.

An article written by A. K. Deb and A. K. Sarkar which proposed a procedure for optimizing a hydraulic network design was discussed and criticized. The discussion noted two major errors in the method: (1) it does not necessarily find the minimum cost equivalent pipe network; and (2) the cost after conversion to actual lengths and diameters is not the same as the equivalent network cost, and the flow values yielding the minimum cost equivalent network do not necessarily yield the minimum cost actual network. The discussion reviewed and corrected solution equations used in the article and pointed out the limitations of the iterative procedure used. It was also noted that the optimization problem as formulated was not sufficiently realistic nor were the authors aware of practical solutions to either of the problems reported in the discussion. (Markell-Cornell)
W71-13979

WATER QUALITY MODELS, (Appendix A).
Department of Environment, Ottawa (Ontario). Directorate of Policy Planning.
For primary bibliographic entry see Field 05B.
W71-13981

6B. Evaluation Process

A CITIZEN PANEL FOR ATLANTA AREA STUDIES: FIELD EXPERIMENTATION AND METHODOLOGICAL SUBSTUDIES,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
C. M. York, and G. D. Basket.
Available from National Technical Information Service as PB-202 984, $3.00 in paper copy, $0.95 in microfiche. Environmental Resources Center, Georgia Institute of Technology, ERC-0271, June 1971. 64 p, 3 fig, 39 tab, 51 ref, 1 append. OWRR B-045-GA (1).

Descriptors: *Attitudes, *Public behavior, *Behavioral measurement, *Social values, *Political aspects, Water resources development, Environmental management, Community development, Urban sociology, Administrative decisions, Political constraints, Urbanization, City planning, Georgia.
Identifiers: *Atlanta (Ga), *Southeast U.S., Source credibility.

The research was designed to ascertain how public behavior relates to water resources planning and management. This was accomplished through 'instrument development' and field tryouts relating to the broad question of citizen-conceived environmental quality and the relative importance attributed by the public to water-resource issues. A major Southeast urban area served as the initial data source for preliminary problem-oriented information from people. Sampling design and implementation was accomplished on a range of topics. Substudies empirically tested the telephone interview as a viable method for gathering qualitative data about the environment and other citizen-perceived urban problems and provided citizens data of theoretical and methodological significance relating to perceived source credibility. Trustworthiness of officials and agencies by the public was found to be a major variable in the communication process. Ratings on 51 issues obtained in telephone interviews bearing on public perception of environmental priorities were analyzed in search of the underlying dimensionality of environmental concern. Specific item clusters were developed, but the salient issues were water and air pollution control, crime control, and drug control. Data developed from Atlanta residents constitute a base for continuing research relating to urban priorities in Atlanta and elsewhere. Research findings contribute to the understanding of citizen concern for national and environmental issues. (Conway-Ga. Tech)
W71-13166

REVIEW OF NATIONAL RESEARCH POLICY ON EUTROPHICATION PROBLEMS,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 05C.
W71-13172

WATER RESOURCE MANAGEMENT IN THE UPPER POTOMAC BASIN.
Interstate Commission on the Potomac River Basin, Harrisonburg, Va.
For primary bibliographic entry see Field 05G.
W71-13195

REPORT ON THE FRAMEWORK STUDY.
Nebraska Soil and Water Conservation Commission, Lincoln.
For primary bibliographic entry see Field 06E.
W71-13202

SYSTEMS ANALYSIS FOR URBAN WATER SUPPLY AND DISTRIBUTION,
Parsons, Brinckerhoff, Quade and Douglas, New York. Advanced Technology Div.
For primary bibliographic entry see Field 06A.
W71-13212

AQUEDUCTS FOR LEAST COST CONVEYANCE OF WATER, 37 DEG 32 FT N 45 DEG 5 FT E,
Rezaiyeh Coll. (Iran).
For primary bibliographic entry see Field 08A.
W71-13216

A MULTI-BASIN PLANNING STRATEGY,
Texas State Water Development Board, Austin. Systems Engineering Div.
For primary bibliographic entry see Field 06A.
W71-13218

SPATIAL ALLOCATION MODEL FOR PROJECTED WATER BASED RECREATION DEMAND,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06A.
W71-13225

THE FACTORS LIMITING REALIZATION OF THE FULL POTENTIAL OF RESOURCES OF THE COASTAL ZONE,
Bureau of Commercial Fisheries, Woods Hole, Mass.
For primary bibliographic entry see Field 05C.
W71-13245

ECONOMIC ASPECTS OF ALGAE,
Louisville Univ., Ky. Dept. of Biology.
For primary bibliographic entry see Field 05C.
W71-13246

FOOD FROM THE SEA: BRIGHT HOPE OR ILLUSION.,
Florida Dept. of Natural Resources, Tallahassee. Marine Research Lab.
For primary bibliographic entry see Field 05C.
W71-13261

THE PRESENT RELATIONSHIP BETWEEN WATER-RESOURCES PROBLEMS AND CONTROLLED CULTURE OF MARINE AND FRESH-WATER ANIMALS,
Aquatic Sciences, Inc., Boca Raton, Fla.
For primary bibliographic entry see Field 05C.
W71-13263

METROPOLITAN PENSACOLA FIVE YEAR SEWER PLAN.
Flood and Associates, Inc., Jacksonville, Fla.

Available from the National Technical Information Service as PB-200 132, $3.00 in paper copy, $0.95 in microfiche. Escambia-Santa Rosa Regional Planning Council, Pensacola, Florida, April 1971. 112 p, 28 fig, 12 tab. FLA. P-130 (HUD Grant).

Descriptors: *Planning, *Sewer systems, *Water pollution control, *Sewage treatment, *Sewage disposal, Urbanization, Cities, Florida, Programs, Administration, Sanitary engineering, Sewers.
Identifiers: *Pensacola (Fla.), Sanitary district.

Recommendations are presented for a program of public improvements to be implemented in Metropolitan Pensacola. The purpose is to overcome pollution problems and inadequacies of existing facilities to serve major portions of urban population groups. A master plan is described for the collection, treatment and ultimate disposal of domestic, commercial and industrial wastes. Most critically needed elements of the Master Plan are recommended for construction as an immediate five year program. Implementation costs of the five year plan are estimated to be $36.2 million for urban Pensacola, $2.8 million for non-urban Escambia County, and $5.0 million for Santa Rosa County. A single public utility is recommended to provide for both the water supply and sewage systems in the entire urban area. Individual systems are recommended for outlying developed areas. Implementation guidelines relative to organization, administration and financing are presented. (Poertner)
W71-13559

DISTRICT-WIDE WATER AND SEWER PLAN, STAGE ONE.
Upper Savannah Planning and Development District, Greenwood, S.C.

Available from the National Technical Information Service as PB-200 098, $3.00 in paper copy, $0.95 in microfiche. May 1971. 45 p, 5 fig, 11 tab, 5 ref. HUD Proj. No. S.C.P.-43, SC-40-0014-0352.

Descriptors: *Planning, *Grants, *Federal project policy, *Programs, *Loans, Construction, Cities, Urbanization, Water supply, Sewer systems, Water districts, Water resources development, Community development, Political aspects.
Identifiers: *Regional planning, *Areawide development, Water and sewer facilities.

Planning water and sewer facilities from a regional or district approach is discussed. The geographical area studied is the Upper Savannah Planning and Development District which includes 6 counties: Abbeville, Edgefield, Greenwood, Laurens, McCormick and Saluda. The objective was to provide for District residents the required planning for providing community water and sewer systems of minimal cost. The report provides an inventory and evaluation of existing water and sewer planning, other functional planning, and comprehensive planning within the District. A recommendation is made to designate the District as the Areawide Planning Organization representing the 6 member counties to meet planning requirements for various HUD capital grant and loan programs. The District should be designated as an Areawide Planning Jurisdiction for the 6 countries. A proposed planning program to be undertaken by the APO for the APJ is outlined as a basis for subdistrict areas to become and remain qualified for needed HUD capital grant and loan programs. The most urgent comprehensive and functional planning elements needed at this time include Water and Sewer (Stage III), Land Use, and Regional Goals Plans. A subsequent study (Stage II) is planned. The objectives will be to coordinate the findings of this study and to begin implementation of recommended actions. (Poertner)
W71-13564

WATER, SEWER AND DRAINAGE PLAN, COMPREHENSIVE PLANNING STUDY, BLYTHEVILLE-GOSNELL, ARKANSAS.
Ellers, Reaves, Fanning and Oakley, Engineers; and Manes and Associates, Inc.

Available from the National Technical Information Service as PB-199 922, $3.00 in paper copy, $0.95 in microfiche. Blytheville-Gosnell Joint Planning Commission, Blytheville, Arkansas, April 1971. 18 p, 3 fig, 1 tab. HUD Proj. No. ARK P-116.

Descriptors: *Planning, *Sewer systems, *Drainage systems, *Water supply, *Waste water disposal, Cities, Urbanization, Arkansas, Inflow, Administration, Sanitary engineering, Water demand, Storm drains, Treatment facilities, Oxidation lagoons, Programs, Forecasting.
Identifiers: *Blytheville (Ark.), Gosnell (Ark.).

A plan is presented for future water, sewer and drainage needs for the Blytheville-Gosnell Urban Area. The plan is based on projected growths for 10 year and 25 year programs. The Sanitary Sewerage System Study provides an estimate of future sewage volume and characteristics and is based on projected growth. The study includes a description of future lift stations and treatment facilities, required force main sizes, their general location and cost estimates. The water system study provides an estimate of future demands for the Blytheville-Gosnell Urban Area. Cost estimates reflect only the mains that will be needed during the next 25 years. Storm drainage improvements have been projected and are shown graphically on a storm drain map. Drainage constitutes an unusually significant problem in the area due to the flat terrain and consequently high cost of structures. The report makes no attempt to divide the plan into short or long range projects, rather each drainage item needed is assigned a cost figure and a total combined figure is then given. The report includes evaluations of existing sewer, water drainage facilities and identifies deficiencies in these systems. The problems of providing sewerage in the area are compounded by the terrain which is essentially without slope. In addition to the normal flow of domestic, commercial and industrial wastes, the sewers carry large amounts of infiltration flows. Storm sewers are being constructed in Blytheville during urban renewal project work. (Poertner)
W71-13566

THE IMPACT OF THE WATER '70 CAMPAIGN,
University of the Witwatersrand Univ., Johannesburg (South Africa). Dept. of Hydraulic Engineering.
D. C. Midgely.
South African Journal of Science, Vol 67, No 4, p 269-272, April 1971.

Descriptors: *Water conservation, *Social aspects, *Planning, *Water policy.
Identifiers: *South Africa.

South Africa's Water '70 campaign, an effort to inform and involve the citizens of the semiarid nation in all facets of water problems, was launched while the country was in the throes of an extreme drought, and closed with widespread relieving rains. A Water Year emblem was adopted; scientific, agricultural, technical, and cultural societies devoted attention to the theme; and songs, poems, operettas, books, and films were expressly commissioned. A specially appointed commission on water matters made the following recommendations: (1) adoption of a realistic water pricing policy; (2) increased reclamation and reuse of effluents as a pollution control measure; (3) restraint in extending the use of water for irrigation purposes; (4) improvement in water use efficiency; and (5) accelerated research into all aspects of water resources, water utilization and pollution control. With minor reservations, the report was adopted by parliament, and legislation was introduced to facilitate implementation of some of the recommendations. In evaluating the success of the program in informing the public, it was felt that perhaps a year was too long for carrying on such a high pressure campaign, and that many people may have 'switched off'. It is extremely important to create an informed public opinion and perhaps for the long run it is wise to stimulate interest among school children. The immediate concern is that both public and administrators will return to a condition of lethargy before another drought occurs. (Casey-Arizona)
W71-13572

REGIONAL WATER RESOURCES PLANNING IN SOUTH AFRICA,
J. L. Stallebrass.
South African Journal of Science, Vol 67, No 3, p 159-165, March 1971. 1 fig, 2 tab, 3 ref.

Descriptors: *Planning, *Runoff, *Water policy, River basins, Economic feasibility, *Regional analysis, Irrigation.
Identifiers: *Catchments.

In 1965, the population of South Africa was 18 million. With an annual growth rate of 2.65%, it is estimated the population will reach 45 million by the year 2000. Even if growth slows considerably after 2000, a population of 141 million by 2050 is likely. While the country is richly endowed with mineral resources, the total water supplies available are relatively sparse in relation to the expected population increases. Mean annual runoff has been determined at 19,693,800 morgen-ft (1 morgen-ft equals 575,000 gallons) which is equivalent to an average runoff of 41 morg-ft/sq mile. By comparison, mean annual runoff in the 48 contiguous states of the U.S. averages 233 morg-ft/sq mile. It is therefore obvious, against this general background, that intensive national and regional water planning to ensure optimal resource allocation and use efficiency in the future is necessary. Thus far, it has been the policy of the Minister of Water Affairs to entrust water resources development planning at the regional level to specially appointed committees comprised of specialists from both the public and private sectors. In determining the boundaries of regional areas for purposes of water resource planning, such boundaries, wherever possible, follow the watersheds of river basins although in certain areas, groundwater resources must also be considered. Nine hydrological regions have been laid out and their areas and mean annual runoff are summarized. The major considerations in water policy planning are the problem of the excessive amounts of water allocated to irrigation, intercatchment water transfers and the indeterminate factor of desalination. (Casey-Arizona)
W71-13579

A NEED FOR THE CENTRAL ARIZONA PROJECT,
D. Yetman.
Booklet, Committee For A Sane Water Policy, Tucson, Arizona,. 12 p, 3 fig, 3 tab, 7 ref.

Descriptors: *Arizona, *Water policy, *Water quality, *Economic feasibility, *Water costs, Social aspects, Cost-benefit analysis, Wildlife, Phreatophytes, Recreation, Reclamation, Arid lands, Water demand, Agriculture, Irrigation practices, Water users, Municipal water, Evaporation, Salinity.
Identifiers: *Central Arizona Project.

The Central Arizona Project (CAP), which will divert water from the Colorado to an area between Tucson and Phoenix, has been heralded by supporters as offering almost unlimited economic benefits to the state. It is asserted here that analysis of the economic, ecologic and social effects of the project do not support these claims. The most basic argument is that because the river is already overallocated, little water is available for the CAP. A further reduction in water will result from evaporative losses, estimated at 200,000 acre-feet per year. The dissolved solids at the diversion point, Lake Havasu, have recently ranged between 546-826 ppm. This will raise considerably the levels in municipal water supplies, and pose questions as to its usefulness to agriculture. The only solution to this problem, desalination, will add a cost of 20 dollars per acre-foot. The Orme, Buttes and Charleston dams will flood large acreages and stop free-flowing portions of rivers and streams. This, and phreatophyte control projects, will destroy many important and unique wildlife habitat as well as popular recreation areas. The Yava-pai-Apache Indian Tribe on the Fort McDowell Indian Reservation will be flooded out from their homes, jobs and income. Current indications are that the Tribe will be compensated with a pittance, despite their rising protests. It is estimated that CAP water costs will be 10 dollars/ac-ft for agricultural users and as high as 100/dollars/ac-ft for municipal and industrial users. Current Phoenix municipal water costs are at most 2 dollars/ac-ft. This amounts to a huge subsidy to the farmers by all other users, and even with this, only those raising high return crops such as cotton or sugar beets will be able to afford the water. (Casey-Arizona)
W71-13597

A QUANTITATIVE ANALYSIS OF FACTORS INFLUENCING RESIDENTIAL LOCATION IN RESERVOIR RECREATION AREAS,
North Carolina Univ., Chapel Hill. Center for Urban and Regional Studies.
R. J. Burby, III.
Journal of Leisure Research, Vol 3, No 2, p 69-80, 1971. 1 fig, 3 tab, 4 ref, 1 append.

Descriptors: *Recreation demand, *Land use, Multiple-purpose reservoirs, Access routes, Shores, Long-term planning, Regression analysis.
Identifiers: *Residential location, *Land use model, Lake Sidney Lanier Reservoir (Ga.).

Many factors influence temporary residential location in reservoir recreation areas. An analysis of these factors can lay the foundation for a residential model to forecast reservoir-oriented land development. The study area (Lake Sidney Lanier reservoir in Georgia) was divided into cells and land in residential use, both on the shoreline and away from it, was measured in each cell. Independent variables affecting land use were also measured. A linear form of multiple regression analysis was used to identify and evaluate these variables. Variables affecting shoreline residential development in decreasing order of importance include quality of road access, access to Atlanta, access to the shoreline and availability of public utilities. Non-shoreline development is affected by availability of public utilities, quality of road access and absence of ground cover. This analysis has two important results: (1) planners, using the key role played by road accessibility, can shape future shoreline development to meet predetermined public land use objectives and (2) the gap between theories of urban and regional spatial structures can be narrowed. It is suggested, however, that a better understanding of the way residential decisions are actually made and a redefinition of land available for residential use will help perfect the analysis. (Berg-Wisconsin)
W71-13647

COMMUNITY PROBLEMS IN RESERVOIR RECREATION AREAS,
North Carolina Univ., Chapel Hill. Inst. for Research in Social Science.
R. J. Burby, III., and S. F. Weiss.
Research Previews, Vol 18, No 1, p 1-13, 1971. 6 tab, 4 ref.

Descriptors: *Recreation, *Reservoirs, *On-site date collections, Planning, Drawdown, Waste disposal, Social aspects, Sampling, North Carolina.
Identifiers: *Lake Norman (North Carolina), *Lake Sidney Lanier (Georgia), *Social problems, Shoreline property, Water recreation.

A survey of 268 recreational households in North Carolina and Georgia was taken to determine both the incidence and perception of community problems in reservoir recreation areas. Detailed information on household characteristics and perception of community problems is presented in tabular form. The sampled households tended to perceive problems salient only to their own recreational and proprietary interests. Awareness of more general problems common to the surrounding community was usually lacking. The problems cited most often include vandalism, refuse disposal, drawdown of the adjacent reservoir, water safety, and fire protection. Those problems mentioned least include race relations, traffic, local rural poverty, quality of local schools, and nuisances such as air pollution. The perception of problems depended somewhat on the household's objective in purchasing shoreline property. Households acquiring property primarily as a residence perceived problems more often than either recreation- or investment-oriented households, and were much more aware of community-type problems. Thus, residence-minded households may provide the strong support necessary for a balanced program of planning and policies designed to alleviate problem situations. (Settle-Wisconsin)
W71-13648

THE EVALUATION OF RECREATION BENEFITS: THE CLAWSON METHOD IN PRACTICE,
Birmingham Univ. (England). Dept. of Industrial Economics and Business Studies.
R. J. Smith.
Urban Studies, Vol 8, No 2, p 89-102, 1971. 3 fig, 6 tab, 9 ref.

Descriptors: *Cost-benefit analysis, *Recreation demand, *Fishing, Demand, Benefits.
Identifiers: *Clawson Method, Sensitivity testing.

An empirical evaluation of the Clawson Method of deriving a demand curve for recreation sites was undertaken with the view toward determining monetary benefits of water-based recreation activities. The distance traveled to a particular site was plotted against the number of visits (per 100,000 population, to eliminate population density distortions). By giving a monetary value to these distances (multiplying them by the driving cost per mile) an initial demand curve was constructed. A final demand curve showing the relation between the number of visits to the recreation site and the actual charge for admission was derived from the initial demand curve by adding various admission charges to the cost schedule and aggregating the total number of visits that would be undertaken at each admission price. The economic benefits of the recreation site were then calculated as the total area beneath this final demand curve. Given different assumptions about visitor behavior, several equations were successfully fitted to the curve. Because of the sensitivity of this analysis to different assumptions regarding travel costs per mile, forms of demand equations and time values, these variables must be chosen with great care to ensure valid results. (Wade-Wisconsin)
W71-13649

AN ESTIMATION OF THE QUANTITATIVE IMPACT OF THE ST. LAWRENCE SEAWAY ON THE HINTERLAND'S ECONOMY,
Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.
E. Schenker, S. Tee Koh, J. Kochan, and M. Bunamo.
In: Proceedings of the 13th Conference of Great Lakes Research, 1970. International Association of Great Lakes Research, p 168-186, 15 tab, 13 ref.

Descriptors: *Employment, *Economic impact, Regression analysis, Income analysis.
Identifiers: St. Lawrence Seaway, Great Lakes region.

The economic impact of the St. Lawrence Seaway is examined by isolating factors producing changes in total employment. Total employment data is used. This analysis is based on the hypothesis that an increase in non-localized or export employment will increase localized employment by an amount greater than the initial increase. Industries were first classified as localized or non-localized and their total employment separated into localized and non-localized sectors. A linear regression was then done to estimate the influence of non-localized on localized employment. From this estimate the income-employment multiplier was derived. The employment-income multipliers of the six states covered by this study ranged between 1.8756 and 2.6380. The revenue earned at the lake ports from Seaway cargo is non-localized income which generates secondary income and employment. To estimate the primary income earned at the ports plus the secondary income derived from it, the income multipliers were applied to the primary income. This yielded an estimated $643 million for the total Seaway-cargo generated income in the Great Lakes hinterland. This income indicates the important positive effect the Seaway has had on the economy of the Great Lakes region. (Dyer-Wisconsin)
W71-13653

AN ECONOMIC ANALYSIS OF ORGANIZATIONS OF WATER USERS,
Iowa State Univ., Ames.

Charles W. Meyer, J Ronnie Davis, and R. A. D. Beck.
Available from the National Technical Information Service as PB-203 347, $3.00 in paper copy, $0.95 in microfiche. Iowa State Water Resources Research Institute, Ames, Completion Report ISW-RRI-44, August, 1971. 26 p, 3 fig, 11 ref. OWRR B-011-IA (1).

Descriptors: *Organizations, Institutions, Institutional constraints, Iowa, Water quality, *Water utilization, *Social aspects, *Water allocation, Costs, Benefits.
Identifiers: *Public goods, *Public 'bads,' *Externalities, Internalization, Input-output model, *Functional economic area, *Ottumwa (Iowa), Economic model.

This investigation began with the generally accepted hypothesis that uncoordinated action by individual water users will result in an inefficient use of water resources, including water quality. The concepts of a private good, public good, joint supply of private and public goods, public 'bads' such as pollution (provided in conjunction with the production or consumption of a private or public good), and ownership externality are introduced and employed to demonstrate the various ways in which the market fails as an allocative mechanism for water resources. Because of the public-good nature of water quality, no organizational structure can be expected to overcome completely the misallocation that results from market failure. Internalization under a single decision unit will still result in arbitrary decisions on matters affecting both allocation and distribution of costs. The investigators concluded that the basic unit for water resource planning in Iowa is the functional economic area (FEA), a relatively self-contained area with respect to retail trade, services, and social interaction. An input-output model of the FEA centered on Ottumwa, Iowa, has been constructed for the purpose of studying the interrelationship of water resource policy with regional economic and demographic variables. The model should serve as a basis for future work on the linkages among FEA's on the Des Moines River in Iowa.
W71-13657

ECONOMIC ASPECTS OF WATER WELL STIMULATION,
Koenig (Louis) Research, Inc., San Antonio, Tex.
For primary bibliographic entry see Field 04B.
W71-13719

COMPREHENSIVE FRAMEWORK PLANNING IN THE COASTAL ZONE,
Center for the Environment and Man, Inc., Hartford Conn.
W. V. McGuinness, Jr.
In: Marine Technology Society 7th Annual Conference, August 16-18, 1971, Washington, D.C., p. 437-446. 10 enclosures.

Descriptors: *Long-range planning, *Land use, *Water resources development, *Land resources, Administration, Multiple-purpose projects, Legislation, Federal government, Administrative agencies.
Identifiers: *Coastal zone planning, U.S. Water Resources Council, North Atlantic Regional Water Resources Study, Framework planning.

For coastal zone planning and management to be integrated with broad, long-range, and regional framework plans for water and related land resources in large regions, an orderly system for encompassing many considerations and producing strategic generalizations will be necessary. The framework studies of the U.S. Water Resources Council provide a good base. The North Atlantic Regional Water Resources Study and its Appendix U illustrate one way this integration can be attempted. (Currer-PAI)
W71-13729

THE NECESSITY OF LOCAL SUPPORT IN COASTAL ZONE PLANNING,
Interstate Electronics Corp; Anaheim, Calif. Oceanics Div.
W. B. Merselis.
In: Marine Technology Society 7th Annual Conference, August 16-18, 1971, Washington, D.C., p 447-451.

Descriptors: *Local governments, *City planning, *Land use, Coasts, Environmental effects, Community development, Long-term planning, Legislation.
Identifiers: *Coastal zone planning, Funding, Multiple-use programs, Conservation programs.

Carefully planned programs for multiple uses and management of marine-oriented environments are rare. Population pressure and instances of waste, pollution, and neglect have created a demand that such problems be recognized, studied, and solved. An illustration is made of how numerous groups and agencies might become involved in a cooperative program for the feasible solution of multiple use and conservation for a coastal zone. (Currer - PAI)
W71-13730

AN ANALYTICAL PROCEDURE FOR COASTAL ZONE ALLOCATION DECISIONS,
Gulf Universities Research Corp., Galveston, Tex.
For primary bibliographic entry see Field 02L.
W71-13731

OCEAN ISLANDS -- ROSETTA STONES FOR COASTAL CITIES,
Environmental Protection Agency, Washington, D.C.
W. S. Beller.
In: Marine Technology Society 7th Annual Conference, August 16-18, 1971. Washington, D.C., p 473-482. 2 tab, 23 ref.

Descriptors: *City planning, *Land use, *Long-term planning, *Analog models, Hawaii, Environmental effects, Coasts, Islands, Virgin Islands, Ecosystems.
Identifiers: *Coastal metropolitan areas, Ecosystem stability, Resource allocation.

Metropolitan areas on the coasts of the mainland are as bounded by their reserves of natural resources as ocean islands. Ocean islands because of their complete domination by the sea behave as pure coastal zones. They may be considered to be theoretical models of coastal metropolitan areas, and like analog computers, monitored to give insights into the healthful use and management of mainland areas. (Currer-PAI)
W71-13732

URBAN IMPACTS ON COASTAL ZONE MANAGEMENT,
Coastal Zone Resources Corp., Muskegon, Mich.
W. J. Hart and S. P. Walker.
In: Marine Technology Society 7th Annual Conference, August 16-18, 1971, Washington, D.C., p 483-499.

Descriptors: *City planning, *Project planning, *Long-term planning, Land use, Economic life, Community development, Human resources, Industries.
Identifiers: *Coastal zone management, Muskegon, Michigan, Muskegon Standard Metropolitan Statistical Area, Value Systems.

The increasing urbanization of coastal areas and the conflicts that it brings about between man's activities and maintenance of environmental quality has led to the notion that some form of planning and management is necessary to facilitate maximum returns to society. A survey of data derived from a typical coastal metropolitan area and a discussion of general factors that enter coastal zone management shows that standard planning information inadequately reflects the real situation, and can confuse the search for appropriate management schemes. The success of the States in solving their problems will be related to their use of multicounty regions as effective extensions of government with the ability to reconcile differences among local, state, and national value system. (Currer-PAI)
W71-13733

ECONOMIC TOOLS FOR EVALUATING COASTAL DEVELOPMENT: THE CHESAPEAKE BAY ENIGMA,
Johns Hopkins Univ., Baltimore, Md.
R. A. Luten.
In: Marine Technology Society 7th Annual Conference, August 16-18, 1971, Washington, D.C., p 503-508. 13 ref.

Descriptors: *City planning, *Long-term planning, Economics, Shore protection, Land tenure, Social impact, Area redevelopment, Short-term planning, Legislation, Coastal engineering.
Identifiers: *Coastal development, *Economic intelligence, *Chesapeake Bay, Public planning agencies.

Planning information, in the form of economic intelligence, can contribute to the resolution of competing claims for the coastal zone. Economic intelligence can help to set seasonable bounds on the spatial management problem by indicating resource scarcities, alternative options, and the complementarity of resource activities. It can help to set coastal zone use priorities on the basis of land values corrected for market imperfections. (Currer-PAI)
W71-13735

PROBLEMS IN THE TRANSFORMATION OF RIVER SYSTEMS (Problemy preobrazovaniya rechnykh sistem),
For primary bibliographic entry see Field 04A.
W71-13862

GROUNDWATER MANAGEMENT IN DEVELOPMENT OF A NATIONAL POLICY ON WATER,
National Water Commission, Arlington, Va.
For primary bibliographic entry see Field 04B.
W71-13872

REPORT ON SECOND ANNUAL CONFERENCE OF WATER RESOURCES CENTER DIRECTORS.
Office of Water Resources Research, Washington, D.C.

Held on January 24-25, 1967, at Washington, D.C. 177 p, 4 fig, 4 chart, append.

Descriptors: *Water resources, *Research and development, Water resources development, Planning, Cost allocation, Water quality, Water conservation, Ecology, Urbanization, Federal government.
Identifiers: *Water research, *Water resources planning.

Eight papers presented were at the second Annual Conference of Water Resources Center Directors in January 1967. In addition, six related panel discussions are summarized. The overall purpose of the Conference was to develop research programs under P.L. 88-379. These programs were to be responsive to the needs discussed in the report, 'A Ten Year Program of Federal Water Resources Research' which was released by the Committee on Water Resources Research of the Federal Council for Science and Technology. The papers are concerned with aspects of water resources planning such as: Federal water resources programs (Robert L. Smith), water planning (Henry P. Caulfield, Jr.), cost allocations (Eugene W. Weber), water quality management (Leon W. Weinberger), water conser-

vation (Edward A. Ackerman), ecological impacts of water resources development (Stanley A. Cain), and the effects of urbanization (Samuel S. Baxter). (Strachan-Chicago)
W71-13882

PROBLEMS IN DEVELOPING A NATIONAL FLOOD-PROTECTION POLICY,
A. Wolman.
In: Water, Health and Society, Indiana University Press, 1969, p 148-159. 1 ref.

Descriptors: *Flood protection, *Flood control, *Decision making, *Planning, *Formulation, Engineering, Local governments, Governments.
Identifiers: *Policy, *National Flood Protection Policy, Policy making.

It is maintained that the development of a National Flood Protection Policy should not be separate from the development of a National Water Resources Policy in general. In developing a National Flood Protection Policy, engineering aspects are of the utmost importance, but they should not be the sole concern of those who are involved with this field. Six statements are made about the state of flood protection (as of 1937). (1). Engineering studies of past floods are incomplete. (2). Carefully prepared plans for flood protection are lacking in many areas. (3) In the decision making process and in policy formulation, more engineering information and conclusions are needed. (4) A leadership which will balance local and national needs, and costs against assessments of benefits is needed. (5) Local areas need to develop a more acute awareness of their own social responsibility. (6) Protection of a local area should meet the flood protection needs of the community, while at the same time be designed for the social and economic advantages of the nation in respect to all water uses. The crucial decisions in the formulation of a National Flood Protection Policy should not be made in times of stress and emotion following a crisis. Such decisions should be made while public interest is at its height. (Strachan-Chicago)
W71-13889

A RIVER, A REGION, AND A RESEARCH PROBLEM,
Washington Univ., St. Louis, Mo. Inst. for Urban and Regional Studies.
C. L. Leven, and R. B. Read.
U.S. Army Corps of Engineers Institute of Water Resources Report 71-6, July 1971, 315 p, 18 fig, 38 tab, 385 ref, 7 append.

Descriptors: *Economic impact, *Cost-Benefit analysis, *Planning, *Multiple purpose projects, *River Basin development, Input-Output analysis, Arkansas, Regions, Social aspects, Political aspects.
Identifiers: *Arkansas River basin, Plan formulation.

This research was undertaken in an effort to develop a theoretical framework of an empirically feasible procedure for assessing the broad economic, social, political and environmental impact of the McClellan-Kerr Arkansas River Multiple Purpose Project. The report presents a methodology for projecting the efficient location of water related industry via regional linear programming. The spatial general equilibrium approach allows an analysis of the without condition, generally intractable in expost analysis. Methodology for analyzing other social, political, and environmental impacts are advanced, with less empirical and comprehensive theoretical content. Yet the strategy of general equilibrium analysis is maintained. (Brown-OWRR)
W71-13902

EFFECTIVE WATER QUALITY MANAGEMENT: IMPOSSIBLE DREAM OR ATTAINABLE GOAL,
Syracuse Univ., N.Y. Water Resources Center.
R. D. Hennigan.
In: Proceedings of the 13th Conference of Great Lakes Research, 1970, International Association of Great Lakes Research, p 149-155. 6 ref.

Descriptors: *Great Lakes Region, *Water quality control, *Administrative agencies, *Ethics, *Project planning, Social impact, Preservation, Public health.
Identifiers: Institutional reform, Economic exploitation.

The Great Lakes Region faces a crisis as tremendous waste loads burden the environment without effective water quality management. The elements controlling water quality management are the operable ethic (intellectual base for public policy) and institutional arrangements (tools to effect meaningful policy through regulatory activity and to operate facilities). At present the operating ethic is economic-exploitive, which, coupled with unresponsive, archaic institutions, dooms any attempts at water quality control. At the other extreme is the preservation ethic which argues that natural resources should remain untouched. Both of these ethics are anti-people. What is needed is an ecologic-human ethic which recognizes the primacy of man's needs and desires and the necessity to reconcile him with his environment for everyone's benefit. Institutional reform should include agencies and programs on all levels of government with the ecologic-human ethic as a guidepost to policy planning. Out of these reforms will come a workable system incorporating persuasion and education, legal action, and economic incentive which can make effective water quality management an attainable goal. The alternative is a steadily worsening environmental situation, a declining quality of life, and the possibility of a serious environmental disaster. (Haugh-Wisconsin)
W71-13940

THAMES ESTUARY DEVELOPMENT: 'THE MIDAS TOUCH',
Port of London Authority (England).
N. N. B. Ordman.
Vernon-Harcourt Lecture, January 27, 1971. 6 fig, 2 ref.

Descriptors: *Economies of scale, *Civil engineering , *Project planning, *Land reclamation, *Dredging, *Ships, Oil industry, Steel, Human population, Pollution abatement.
Identifiers: *MIDAS, *Maplin Sands, *Thames, Foulness, Population growth rates.

The concept of Maritime Industrial Development Areas (MIDAS) is based on the planned location of industry close to deep-water terminals. The terminals and their support areas and the associated industrial plants, their stockyards and support facilities, require a large area of land capable of development. Maplin Sands, 45 square miles in the outer estuary of the Thames, is such an area. Economies of scale can be realized by employing larger oil tankers and iron ore carriers. Although expensive dredging must be undertaken so that ports can accomodate these carriers, the dredging material could be used for reclamation. The hydraulic and economic aspects of the reclamation plan are examined. The program envisions one oil refinery with three tanker terminals and petrochemical and other processing plants. To meet iron ore needs, three major berths are planned. The seaport will occupy 8000 acres at a total cost of 125 million pounds for dredging, reclamation and construction of port facilities. The key to development in this area is the selection of capital-intensive industries which will not give rise to excessive population growth. In addition technology can be used to make industrial plants unoffensive to their surroundings. (Haugh-Wisconsin)
W71-13941

POLLUTION AND ENVIRONMENTAL CONTROL,
J. Scherer.
Federal Reserve Bank of New York, Vol 53, No 6, p 132-139, June, 1971. 14 ref.

Descriptors: *Pollution abatement, *Water pollution sources, *Water pollution control, Solid wastes, Economic efficiency, Taxes, Costs.
Identifiers: *Social costs, *Private costs, Externalities, Subsidy, Effluent charges, Environmental control.

Damage to the environment (water, air, and land) can usually be traced back to the way goods and services are produced and used. Economic-related environmental problems arise primarily from the dichotomy between private and social costs. The economic approach to this primarily economic problem seeks to transform social costs of production and marketing into private costs so that the price of every marketable product will reflect its full costs of production to the economy. Suggestions for achieving this objective include imposing effluence charges on polluters, assuming that pollution damage can be assessed accurately; setting standards for product performance and for levels of harmful waste disposal; subsidizing the research, development, and use of pollution-control devices and techniques; recycling wastes; and preserving links to nature by, say, setting aside national seashores, parks, and forests. Solving our environmental problems will be very costly. It is not uncommon to find estimates for coping with all forms of pollution problems over the next five years in the range of $50-75 billion. Water pollution may require at least $4 billion annually, while air pollution may require over $4.5 billion annually. (Settle-Wisconsin)
W71-13943

OPERATIONAL MANAGEMENT FACILITIES FOR WATER SUPPLY SCHEMES,
ITT Creed (STC), London (England). Data systems Div.
L. J. Day.
Water and Water Engineering, Vol 75, No 904, p 229-234, June, 1971. 2 fig, 2 tab.

Descriptors: *Water supply, *Telemetry, *Data transmission, *Data processing, *Communication, Cost comparisons, Cost analysis, Data collection.
Identifiers: Running cost analysis, Capital cost analysis, Supply engineering.

A continuing program of mains-laying to interconnect the semi-isolated, local water supply systems and to reinforce trunk mains in Britain has led to the development of complex systems creating problems in operational management. To acquire the maximum performance at minimum cost the right operational tools must be chosen. The article compares facilities for data acquisition, communications and data processing together with the advantages and disadvantages of each. Economy in water supply is also a matter of combining the right operational tools with the proper communications media. Available media-- private cable, rented post office circuits and radio--are discussed and their relative advantages and disadvantages compared. Although there is no simple formula for determining what combination of these media should be used, it is recommended that a hybrid system of all three should be employed in any case. A checklist for possible savings as well as a checklist for estimating capital cost and running costs is included. (Dyer-Wisconsin)
W71-13944

COST-EFFECTIVENESS ANALYSIS OF WASTE MANAGEMENT SYSTEMS,
Battelle Memorial Inst., Columbus, Ohio. Environmental Planning Group; and Polytechnic Inst. of Brooklyn, N.Y. Dept. of Civil Engineering; and Richards of Rockford, Inc.
N. L. Drobny, S. R. Qasim, and B. W. Valentine.
Journal of Environmental Systems, Vol 1, No 2, p 189-209, June, 1971. 7 fig, 4 tab, 10 ref.

Descriptors: *Waste water treatment, *Waste disposal, *Decision making, *Systems analysis, Unit costs, Capital costs, Operating costs.
Identifiers: *Cost-effectiveness analysis, *Decision weighting model, *Technique of paired com-

parisons, *Military bases, Environmental quality management, Navy.

Cost-effectiveness techniques are used to identify the most cost-effective commercially available waste water treatment and disposal system for advanced (500- and 1000-man) military bases in remote areas. A cost-effectiveness analysis is based upon two types of evaluations. The first is a cost analysis which involves delineating all major system components and developing capital and operating cost estimates for each based upon manufacturers' data. The second is system effectiveness which is determined by using a decision weighing model. Fifteen different treatment systems met the stated minimum performance criteria and were included in the analysis. Effectiveness measures were assigned relative weights using the technique of paired comparisons. In descending order these measures include: (1) simplicity of operation, (2) simplicity of installation, (3) operational flexibility and reliability, (4) environmental quality control, (5) manpower requirements, (6) space requirements, (7) power requirements, and (8) relocatability. Tabular and graphical representations of the relationship between total unit costs (capital plus operating) and total effectiveness for the fifteen systems present the results and have guided the Navy in selecting waste management systems. This study is an example of how systems technology can be used to solve complex environmental quality management problems. (Haugh-Wisconsin)
W71-13947

SOME FACTORS INFLUENCING FAMILY EXPENDITURES FOR OUTDOOR RECREATION,
Kentucky Univ., Lexington. Dept. of Agricultural Economics; and First City Bank and Trust Co., Hopkinsville, Ky.
J. D. Wright, and W. H. Bondurant.
Canadian Journal of Agricultural Economics, Vol 18, No 2, p 35-40, July, 1970. 1 tab, 5 ref.

Descriptors: *Recreation, *Recreation demand, *Recreation facilities, *Expenditures, Least squares method, Education, Income, Distance, Age.
Identifiers: *Family expenditures, Louisville (Kentucky).

One hundred and eighty families in Louisville, Kentucky, were surveyed to determine what types of outdoor recreation facilities were being used, their location in relation to the users, and how much urban people were spending for outdoor recreation. The following six factors were hypothesized to be important determinants of the amount of money spent annually for outdoor recreation: family income, education level, distance to recreation facility, amount of time spent in outdoor recreation, age of head of household, and race. Multiple regression analysis indicated that race and age of household head had little influence on money spent on outdoor recreation. Therefore, they were eliminated from the analysis. Multiple regression analysis using the remaining variables produced one coefficient (on educational level) significant at 90% and three coefficients significant at 95%. The regression coefficients suggest that (1) a $500 increase in income implies an average increase of $3.90 spent on outdoor recreation, (2) an increase in education from eight up to eleven years reduces expenditures while further increases boost expenditures, (3) each extra mile driven to a recreation facility increases expenditures by $0.56, and (4) a second week at a facility adds an average of $28.00 to expenditures on outdoor recreation. (Settle-Wisconsin)
W71-13953

PLANNING FOR A NEW TOWN,
Bartholomew (Harland) and Associates, Atlanta, Ga.
Daniel W. Moore.
Proceedings, American Society of Civil Engineers, Journal of the Urban Planning and Development Division, Vol 97, No UP1, p 79-90, April 1971. 11 fig.

Descriptors: *City planning, *Methodology, *Urbanization, Land use, Zoning, Planning.
Identifiers: *New towns, Matrix method, Critical path method, Site surveys.

Techniques developed in the preliminary planning for a new town on a 5,000-acre penal farm site at the edge of Memphis, Tenn are described. The unusual opportunities presented by public ownership and prime location are stressed. As an aid in keeping track of the many possible choices to be made in the planning process, a series of four matrices were devised. It is expected that a large number of reasonable land use plan concepts will be prepared and evaluated to determine which concepts best reflect the community goals and objectives established for the project. The selection and arrangement of land uses on the various concepts will also be compared. A goal matrix, a land use evaluation matrix, and a design evaluation matrix are proposed to aid in the process. A land disposition matrix is to be used in the evaluation of various ways to make the land available to developers. Management of the project is to be accomplished with the aid of the Critical Path Method. (Davis-Chicago)
W71-13960

COMPUTER SYSTEMS FOR URBAN DESIGN AND DEVELOPMENT,
Skidmore, Owings and Merrill.
For primary bibliographic entry see Field 07C.
W71-13961

PROGRAM DECISIONS IN THE ENVIRONMENTAL SCIENCES,
Environmental Science Services Administration, Washington, D.C.
R. M. White.
In: Social Sciences and the Environment, Conference on the Present and Potential Contribution of the Social Sciences, January 31-February 2, 1967. University of Colorado Press. p 9-22, 1 tab.

Descriptors: *Environment, *Decision making, *Planning, Administration, Resources, Resource allocation, Technology, Environmental effects.
Identifiers: Program decisions, Environmental Science Services Administration (ESSA), Environmental programs, Allocation, Implementation, Development, Objective areas, Socio-economic considerations.

The special environmental objective areas of the Environmental Science Services Administration (ESSA) are discussed. These areas are: (1) The Nationwide Natural Disaster Warning System; (2) The World Weather Watch; (3) Weather Modification; (4) Marine environment; (5) Environmental Pollution; (6) Earthquake reporting and prediction. The environmental objective areas are discussed in terms of allocation of limited resources between their competing needs, nonenvironmental alternatives to the provision of additional environmental services, and selective implementation of technological development. These three general problem areas should be considered in all decision making which concerns the development and implementation of environmental programs. Decision making in environmental fields is frequently conducted without extensive analysis of socio-economic considerations. (Strachan-Chicago)
W71-13962

CAN ECOLOGY PROVIDE THE BASIS FOR SYNTHESIS AMONG THE SOCIAL SCIENCES,
S. A. Cain.
In: Social Sciences and the Environment, Conference on the Present and Potential Contribution of the Social Sciences, on January 31-February 2, 1967. University of Colorado Press. p 27-40.

Descriptors: *Synthesis, *Ecology, *Decision making, Environment, Environmental effects.
Identifiers: *Social sciences, *Policy making, Policy formulation, Integration, Disciplines, Interrelationships, Interdisciplinary fields.

The main concern is to decide whether ecology can be used as a basis for the synthesis of the social sciences. Ecology is a field which deals with interrelationships between things, conditions, and processes. It can integrate the various and often diverse interests of the physical, biological, and social sciences. The article discusses the role of the social sciences in research and policy formulation, which guide action programs handling and affecting environmental quality. That ecology can be used as a basis for synthesis in the social sciences is the conclusion. Each discipline, in decision making and policy formulation, must take into consideration the fields of knowledge and understanding of the other disciplines which affect and expand it. (Strachan-Chicago)
W71-13963

GEOGRAPHY: THE CASE FOR THE SPECIALIZED GENERALIST IN A SCIENCE OF ENVIRONMENT,
R. W. Kates.
In: Social Sciences and the Environment, Conference on the Present and Potential Contribution of the Social Sciences, January 31-February 2, 1967. University of Colorado Press. p 53-72, 3 fig, 1 tab, 33 ref.

Descriptors: *Environment, *Specialization.
Identifiers: *Geography, *Specialized generalist, *Environmental science, Social science, Behavioral science, Natural science, Environmental Science Services Administration (ESSA).

The four traditions of geography: a spatial tradition, an area studies tradition, a man-land tradition, and an earth science tradition, are discussed. These four traditions identify geography as an environmental science. The traditions relevant to environmental science are illustrated in a description of the problem of human adjustment to natural hazard, a major concern of the Environmental Science Services Administration (ESSA). This dexcription is used for background information to present suggestions about the role that social scientists and behavioral scientists should play in developing environmental science. (1) There must be recognition of the need for basic research conducted by social scientists into human interaction with the environment; (2) There must be continuous and active exchange between the natural and social scientists; (3) Social scientists must develop a substantive interest in the environment itself; (4) Development of the substantive interest requires investment and direction of funds and people; (5) Modest but continuous support of the field of geography is needed. All of these suggestions combined with the generalist orientation of geographical research will provide a new opportunity to broaden the base of environmental science through the creation of the specialized generalist. (Strachan-Chicago)
W71-13964

PUBLIC POLICY IMPLICATIONS OF ENVIRONMENTAL CONTROL,
L. K. Caldwell.
In: Social Sciences and the Environment, Conference on the Present and Potential Contribution of the Social Sciences, January 31-February 2, 1967. University of Colorado Press. p 77-92, 9 ref.

Descriptors: *Environment, *Research and development, *Political aspects, Ecology, Decision making.
Identifiers: *Public policy, *Environmental control, *Policy making, *Environmental science, *Environmental policy research, Social choice.

Questions of environmental quality and control are almost always reducible to being questions of social choice. The social, and perhaps biological, compulsions of man towards his environment are not understood. The social choices affect the environment in the disguise of political actions. Attempts to understand the political basis of public environmental control lead to investigation of the interactions between the biological and cultural aspects of

human ecology. Four factors: popular attitudes, political institutions, technical-economic feasibility, and time, are identified within social-political behavior, through which environmental policy decisions are made. The article concludes with a discussion of some of the difficulties involved in developing an environmental science. (1) Ecology has been an underdeveloped science; (2) The close relationship between the information and environmental sciences, between ecology and economics, has not received much attention or investigation; (3) The social and behavioral sciences lack the common language and the common fundamental background understanding which is necessary for the teamwork which will progress environmental policy research; (4) A perception of need in the form of defined areas and problems for research and backing by research funds is necessary. (Strachan-Chicago)
W71-13965

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

THE ECONOMICS OF CLEAN WATER.
Senate, Washington, D.C. Committee on Public Works.
For primary bibliographic entry see Field 05G.
W71-13192

POLLUTION CHARGES INCOME AND THE COSTS OF WATER QUALITY MANAGEMENT,
Ohio State Univ., Columbus. Dept. of Economics.
For primary bibliographic entry see Field 05G.
W71-13227

A NEED FOR THE CENTRAL ARIZONA PROJECT,
For primary bibliographic entry see Field 06B.
W71-13597

THE EFFECTS OF NEW YORK STATE ADMINISTERED OUTDOOR RECREATION EXPENDITURES ON THE DISTRIBUTION OF PERSONAL INCOME,
Cornell Univ., Ithaca, N.Y. Agricultural Experiment Station.
Leonard A. Shabman, and Robert J. Kalter.
Agricultural Economics Res 298, September 1969. 71 p, 29 tab, 90 ref. OWRR B-014-NY (1).

Descriptors: *Recreation, *Income distribution, *Welfare (Economics), *Expenditures, *Marginal utility, Costs, Benefits, Progression taxes, Use rates, Income, Discount rate, Capital costs, Resource allocation, Parks, Recreation facilities, New York.
Identifiers: *Net transfers, *Expenditure distribution, *Welfare weights, Willingness to pay, Income classes.

The effects of outdoor recreation expenditures on the equity of distribution of personal income is examined through (1) an examination of net transfer effects of governmental taxes and expenditures and (2) an analysis of the willingness of each income class to pay for benefits received over time. In the first case the total tax burden on a particular income class for recreation was determined and was subtracted from gross transfer payments from recreation to that class. In the second method of analysis the net recreation benefits accruing to a particular income class were determined by subtracting the discounted present value of new recreation benefits. In addition the notion of marginal utility of additional income was attached to both procedures with the use of welfare weights. These weights were derived from the inverse of the progressive marginal rates of the federal income tax structure. The traditional net transfers approach indicates a recreation subsidy by the upper income groups, but with the application of welfare weight the burden of sacrifice becomes less. Using the investment approach with the welfare weights the lowest three out of five income groups receive approximately equal net benefits. Condensed version under title Effects of Public Programs for Outdoor Recreation on Personal Income Distribution appears in American Journal of Agricultural Economics, Vol 51, No 5, p 1516-1549, December 1969.
W71-13646

WATER CUSTOMERS, CRITERIA, AND COSTS,
American Water Works Association, Garden City, N.Y.
For primary bibliographic entry see Field 05F.
W71-13650

FINANCING POLLUTION ABATEMENT WITH MUNICIPAL BONDS,
For primary bibliographic entry see Field 05G.
W71-13673

AN ANALYTICAL PROCEDURE FOR COASTAL ZONE ALLOCATION DECISIONS,
Gulf Universities Research Corp., Galveston, Tex.
For primary bibliographic entry see Field 02L.
W71-13731

POLLUTION AND ENVIRONMENTAL CONTROL,
For primary bibliographic entry see Field 06B.
W71-13943

OPERATIONAL MANAGEMENT FACILITIES FOR WATER SUPPLY SCHEMES,
ITT Creed (STC), London (England). Data systems Div.
For primary bibliographic entry see Field 06B.
W71-13944

CHICAGO INDUSTRIAL WASTE SURCHARGE ORDINANCE,
Metropolitan Sanitary District of Greater Chicago, Ill.
N. E. Anderson and B. Sosewitz.
Journal of the Water Pollution Control Federation, Vol 43, No 8, p 1591-1599, August, 1971. 1 append.

Descriptors: *Industrial wastes, *Waste water treatment, *Taxes, *Unit costs, Liquid wastes, Solid wastes, Biochemical oxygen demand, Flow measurement, Illinois.
Identifiers: *Sanitary district, Ordinance, Reporting, Chicago (Ill.).

The 1970 industrial waste water surcharge ordinance adopted by the Metropolitan Sanitary District of Greater Chicago embodies an equitable method of determining the amount of surcharge. The Sanitary District's total cost for transporting and treating an industrial plant's wastes is computed from unit prices for treating the measured quantities of liquid wastes is ($0.021 per 1000 gallons), biochemical oxygen demand ($0.014 per pound), and suspended solids ($0.024 per pound). A deduction from the computed total cost may be made for the domestic sewage of employees ($0.004 per employee per day worked). From this net cost is deducted the taxes paid by the plant for the Sanitary District's services. The difference, if any, is the surcharge owed the District. Plants emitting less than 3,650,000 gallons of water in any twelve-month period are exempt from the surcharge provided they do not discharge more than 10,000 gallons of wastes daily on any ten days in the twelve-month period. Each plant must conduct its own measurements, sampling, analyses, and computations, and report them monthly with payment of the surcharge to the Sanitary District. All reports are subject to verification by the District. (Russell-Wisconsin)
W71-13945

PROGRAM BUDGETING AND UNCERTAINTY: A CASE STUDY IN ESTIMATING CONSTRUCTION COSTS OF WATER RESOURCE PROJECTS,
Stanford Univ., Calif. Dept. of Civil Engineering.
George Patrick Jonson.
PhD Thesis. Publication EEP-40, Program in Engineering-Economic Planning, Department of Civil Engineering, Stanford University, Stanford, California, March 1971. 115 p, 7 append.

Descriptors: *Budgeting, *Construction costs, *Dams, Cost trends, Correlation analysis, Economic analysis, Planning, Statistical models, *Risks, Costs, Model studies, Reservoirs, Least squares method, Estimating.
Identifiers: *PPBS, *Program uncertainty.

The planning, programming and budgeting systems (PPBS) approach requires that accurate budget estimates of construction costs for planned projects be available. Water resources development projects depend in large part on uncertain conditions of nature, and therefore cost estimates can be highly uncertain. This research was directed toward developing statistical estimating models from data on previously constructed projects in order to provide a means for explicitly considering estimating uncertainty in the planning process. Data on 214 dam and reservoir projects were collected and analyzed by means of multivariate statistical techniques. Five cost factors were identified. These were (a) general scale factor, (b) spillway factor, (c) spillway foundation factor, (d) tunneling factor, and (e) time factor. Linear and non-linear cost estimating models were developed that relate several physical features, e.g. reservoir capacity and installed power capacity, to cost. A procedure is derived for calculating the cost associated with estimating uncertainty. This cost is composed of the sum of the cost of a potential error and the cost of information. The minimum of this sum is defined as the optimal level of uncertainty. Examples of the use of the estimating procedures are given and suggestions for extending the procedures to benefit estimation are offered. (Linsley-Stanford)
W71-13956

6D. Water Demand

WATER--THE DEPARTMENT OF THE INTERIOR'S SYSTEMATIC MANAGEMENT OF A RESOURCE,
Department of the Interior, Washington, D.C. Water Quality and Research.
For primary bibliographic entry see Field 03A.
W71-13189

SYSTEMS ENGINEERING AND WATER RESOURCES IN SOUTHERN NEVADA,
Nevada Univ., Reno. Center for Water Resources Research.
For primary bibliographic entry see Field 06A.
W71-13213

MODEL DEVELOPMENT AND SYSTEMS ANALYSIS OF THE YAKIMA RIVER BASIN.
Washington State Research Center, Pullman.
For primary bibliographic entry see Field 06A.
W71-13228

WASTES FROM BRITISH PAPER MILLS,
Wiggins Teape Research and Development Ltd., Beaconsfield (England).
For primary bibliographic entry see Field 05D.
W71-13420

GENESEE COUNTY PUBLIC UTILITIES CONCLUSIONS REPORT; FLINT-GENESEE COUNTY COMPREHENSIVE LAND USE-TRANSPORTATION PLANNING STUDY.
Genesee County Metropolitan Planning Commission, Flint, Mich.

Available from NTIS. February 1970. 123 p, 10 fig, 28 tab, 4 ref. hud proj. No. Mich-P-155.

Descriptors: *Planning, *Land use, *Water sources, *Public utilities, *Highways, *Distribution, Water demand, Water storage, Water utilization, Water consumption, Cities, Financing, Sewage treatment, Drainage, Michigan, Flood control, Drainage systems, Urbanization.
Identifiers: *Genesee County (Mich), *Land use-transportation plan, Comprehensive plan, Transportation.

An inventory of existing utilities, a description of planned utilities, and a review of policies concerning the provision of utilities in Genesee County are provided. Utilities play an important role in the development of the Comprehensive Land Use-Transportation Plan. Analyses of data and conclusions are presented concerning locational relationships between public utilities and development patterns, and the implications of policies involving the planning, location, and extension of utility services. It is apparent from the inventory and analysis of public utility services in Genesee County that these essential urban services can be made available in the immediate future to a variety of activities throughout most of the County. This capability suggests that the availability of utilities should not be a limiting factor regarding the economic expectations of the area. It is also apparent that because essential public utilities can be made available to many locations, the possible variations in development patterns, both desirable and undesirable, are numerous. This factor increases the need for the metropolitan area to determine and reach its desired goals through sound land use planning and utilization of adequate development controls at both the local and county government levels. (Poertner)
W71-13561

THE MEANING OF THE CENSUS TO WATER UTILITIES,
Bureau of the Census, Washington, D.C.
Donald E. Starsinic.
Paper presented at the Ninety-first Annual Conference, American Water Works Association, Denver, Colorado, June 14, 1971. 17 p, 4 tab, 7 ref.

Descriptors: *United States, *Census, *Human population, *Cities, *Social aspects, Water demand, Urban sociology, Rural areas, Urbanization, Growth rates, Population, Social needs, Social impact.
Identifiers: *Housing, *Households, *Bureau of the Census, Family size.

The report focuses on trends in population age composition, metropolitanization, and housing supply as shown by the 1970 census. We can anticipate, in the next ten years, a thirty million increase in population, very largely concentrated in metropolitan areas, coupled with an unusually large increase in family formations. There will be a need for the construction of record numbers of housing units to accommodate this growth, particularly moderate priced housing. Careful coordination will be required between local governments, developers, and utilities to provide the expanded, housing supply. One of the most useful extensions of the 1970 census coverage is the publication of block statistics for whole urbanized areas rather than only for cities of 50,000 or over. In this way, the whole of the densely settled portion of metropolitan areas is available for study at this microlevel. The 1970 block tables will show population data such as race and broad age-groups as well as housing details. Essentially all census statistics planned for release will be available to the public in 1972, except for some special reports. Unlike the 1960 census, the programming of the 1970 census has been designed to make available to users a maximum amount of information on magnetic tape. The Census statistics and trends and population projections that can be developed from these statistics are vital to the development of expanded water systems in urban areas. (Poertner)
W71-13565

A QUANTITATIVE ANALYSIS OF FACTORS INFLUENCING RESIDENTIAL LOCATION IN RESERVOIR RECREATION AREAS,
North Carolina Univ., Chapel Hill. Center for Urban and Regional Studies.
For primary bibliographic entry see Field 06B.
W71-13647

THE EVALUATION OF RECREATION BENEFITS: THE CLAWSON METHOD IN PRACTICE,
Birmingham Univ. (England). Dept. of Industrial Economics and Business Studies.
For primary bibliographic entry see Field 06B.
W71-13649

PUBLIC AND INDUSTRIAL WATER SUPPLIES OF KENTUCKY, 1968-69,
Geological survey, Louisville, Ky.
D. S. Mull, R. V. Cushman, and T. W. Lambert.
Kentucky Geological Survey Series X, Information Circular 20, 1970. 107 p, 1 fig, 2 tab, 6 ref.

Descriptors: *Water resources development, *Water users, *Water supply, *Consumptive use, *Kentucky, Industrial water, Domestic water, Water yield, Water distribution (Applied), Public utilities, Water utilization, Water quality, Chemical analysis, Hydrologic data, Data collections, Surface waters, Groundwater.
Identifiers: *Public water supply (Ky), *Industrial water supply (Ky).

Data concerning public and industrial water supplies of Kentucky during 1968-69 are presented. An average of about 612 million gallons of water was used daily in 1968-69 for public and industrial water supply in Kentucky. This is an increase in total water use of 29% over 1957-59, and 54% over 1951-53. Public supplies accounted for 31,% and industrial supplies 69% of the total water used in 1968-69. Municipalities and utility water districts furnished water to 2,185,646 people, 84.5% being supplied form surface-water sources and 15.5% from groundwater sources. The average daily use was about 190 million gallons, a 23% increase over 1957-59 and 30% over 1951-53. The average daily per capita use was 86.5 gallons. The per capita use shows a wide range among communities. In general the larger the city or town, the larger the per capita use. Industrial water use in 1968-69 increased about 32% over 1957-59, a larger increase than for public supplies. The average daily use was nearly 423 million gallons, of which about 328 million gallons was self supplied; the remainder was supplied by public water systems. (Woodard-USGS)
W71-13829

PROVIDING REASONABLE WATER SERVICE,
A. Wolman.
In: Water, Health ahd Society, Indiana University Press, 1969, p 133-142. 6 ref.

Descriptors: *Water demand, *Planning, *Future planning (Projected), *Decision making, Reviews, Financing, Administration.
Identifiers: Water service, Adequate criteria.

Reasonable water service must take into consideration the consumers' water demands for all modern water-using devices, including the growing demand for water for gardening purposes. The article outlines six stages in the development of a more reasonable water service for the consumer. (1) Maintenance of continuing technical review - Water uses, water sources, water distribution, and financial aspects of water service must be constantly reviewed and maintained. (2) Development of criteria of adequacy - There are no quantitative criteria of adequate and reasonable water service. (3) Development of public relations programs - Public relations are essential to the relationship between the consumers and the water works officials. (4) Reconciliation of costs and income - (5) Provision for machinery for action in metropolitan areas - One of the greatest omissions of the water works industry is the failure to provide early and promptly enough for the machinery for engineering, administering, and financing water works development. Without this machinery, it is difficult to meet the needs of great shifts in population. (6) Reexamination of improvement financing - Most methods of financing water works which are now favored are restrictive in nature. They do not allow for realistic planning, prompt action, and financing. (Strachan-Chicago)
W71-13888

SOME FACTORS INFLUENCING FAMILY EXPENDITURES FOR OUTDOOR RECREATION,
Kentucky Univ., Lexington. Dept. of Agricultural Economics; and First City Bank and Trust Co., Hopkinsville, Ky.
For primary bibliographic entry see Field 06B.
W71-13953

PROGRAM BUDGETING AND UNCERTAINTY: A CASE STUDY IN ESTIMATING CONSTRUCTION COSTS OF WATER RESOURCE PROJECTS,
Stanford Univ., Calif. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06C.
W71-13956

SYSTEMS ENGINEERING FOR URBAN UTILITIES,
Parsons, Brinckerhoff, Quade, and Douglas, New York. Advanced Technology Div.
For primary bibliographic entry see Field 06A.
W71-13975

6E. Water Law and Institutions

MARINE TOILETS.

Kentucky Rev. Stat. Ann. secs. 235.410 thru 235.420 (Supp. 1971).

Descriptors: *Kentucky, *Water pollution control, *Waste disposal, *Vessels, Water pollution, Water pollution sources, Water quality control, Water pollution effects, Sewage disposal, Sewage treatment, Sewage effluents, Waste water disposal, Treatment facilities, Ships, Boats, Wastes, Regulation, Administration, Administrative agencies, Legislation, Legal aspects.
Identifiers: *Marine toilets.

The discharge into water of sewage or industrial wastes from any vessel shall be prohibited, unless specially authorized by the Kentucky Water Pollution Control Commission. Sewage disposal from holding tanks on vessels is prohibited. Motor boats with marine toilet facilities must be equipped with water pollution control devices. Such devices may be holding tanks, incinerators, or devices with effluent discharges. Specifications; are provided for the various water pollution control devices. All control devices approved for use shall be maintained in satisfactory working condition at all times. The Commission shall, upon request, furnish interested persons a list of the approved types of water pollution control devices currently available and acceptable for use on motorboats. The Commission may issue necessary regulations and enforcement standards. (Smiljanich-Florida)
W71-13128

LITTER CONTROL ACT.

Public Laws of Maine, 1971, ch 405, secs 2261 thru 2271, Maine Legislative Service, (1971).

Descriptors: *Maine, *Environmental sanitation, *Waste disposal, *Regulation, Legal aspects, Legislation, Local governments, Public health, Wastes, Pollution abatement, Domestic wastes, Recreation wastes, Pollutants, Water pollution sources, Water pollution, Garbage dumps, Landfills, Waste dumps.

Due to the failure of government, business, and the public to accept, plan for, and accomplish effective litter control, the legislature enacted the Maine Litter Control Act to insure the enjoyment of a clean and healthful environment and to prevent public health hazards. Littering from vehicles, watercraft, or in any other manner is prohibited unless the property to be littered is designated by the state for refuse disposal or the litter is deposited in a proper receptacle. Other provisions: (1) prohibit spillage from vehicles or trailers, (2) designate enforcement responsibilities, (3) require persons serving the public to provide trash receptacles, and (4) establish maintenance responsibilities for trash receptacles. Violation of any of the sections constitutes a misdemeanor, but each section has differing penalties. Among the types of penalties authorized are: (1) a maximum fine of $100, (2) requiring the offender to remove all trash from a designated area, (3) suspension of driver's license for thirty days, and (4) additional points under the driver's license point system. Municipalities may adopt more stringent regulations, but any less restrictive ordinances are void. (Gallagher-Florida)
W71-13134

WATERCRAFT POLLUTION CONTROL ACT OF 1970.
Michigan Comp. Laws Ann. secs. 323.331 thru 323.342 (Supp. 1971).

Descriptors: *Michigan, *Boating regulations, *Sewage effluents, *Treatment facilities, Legislation, Water law, Legal aspects, Marinas, Boats, Environmental sanitation, Environmental engineering, Pumping, Incineration, Odor, Ultimate disposal, Water pollution effects, Recreation, Water pollution sources, Wastes, Oil, Oil wastes, Inspection, Jurisdiction, Waste disposal, Water pollution control.
Identifiers: *Marine toilets, *Holding tanks.

A person shall not discharge into the waters of this state any litter, sewage, oil, or other liquid or solid materials which render the water unsightly, noxious, or otherwise unwholesome so as to be detrimental to the public health or welfare or to the enjoyment of the water for recreational purposes. It is unlawful to discharge garbage, litter, sewage, or oil from a watercraft used for pleasure or engaged in commerce on the waters of the state. A marine toilet shall not be used unless it is equipped with either a holding tank or an incinerating device which will reduce all sewage on the watercraft to ash. Certain marinas must provide pumping facilities for pumping out marine toilet holding tanks. Oil and oily wastes shall not be discharged from watercraft if they threaten to pollute or contribute to the pollution of waters or adjoining shorelines or beaches. All watercraft are subject to inspection to determine compliance with these requirements. The establishment of requirements for the discharge of sewage, litter, and oil from any watercraft is reserved to the state. (Johnson-Florida)
W71-13148

WATER RESOURCES COMMISSION.

Michigan Comp Laws Ann secs 323.1 thru 323.13 (1967), as amended, (Supp 1971).

Descriptors: *Michigan, *Water pollution control, *Water resources development, *Waste water (Pollution), Legal aspects, Water law, Water pollution, Water quality, Water quality control, Water resources, Administrative agencies, Administrative decisions, Regulation, Standards, Permits, Waste disposal, Waste water disposal, Waste water treatment, Waste treatment, Streambeds, Streams, Streamflow, Flood plains, Sewage, Sewage disposal.

A Water Resources Commission is herein created and its organization, powers, and duties set forth. The Commission may bring actions to enforce laws relating to water pollution and the obstruction of floodways. The Attorney General may prosecute criminal cases arising under the Act. The Commission has the right to enter private property and investigate pollution conditions. The Commission shall establish pollution standards and may determine the volume of water flowing in streams; it shall also have the power to make regulations restricting pollution. No one shall occupy a flood plain, stream bed, or channel without a permit. It is unlawful to discharge injurious substances into water, and such a discharge is prima facie evidence of a violation. Personnel operating waste treatment facilities must be examined and certified. Waste discharge reports are required. Hearing and notice procedures are set forth. Aggrieved persons may petition the Commission for a hearing. Agents of the Commission may enforce the Act and make criminal complaint against violators. Penalties are specified for violation of either the Act or Commission orders. Certain exceptions are set forth. Surveillance fees shall be paid by those, excluding municipalities, who discharge waterborne waste into state waters. (Robinson-Florida)
W71-13155

THE LAND AND WATER CONSERVATION AND RECLAMATION ACT.
Pennsylvania Stat Ann Secs 5101 thru 5121 (Supp 1971).

Descriptors: *Pennsylvania, *Government finance, *Mine wastes, *Water pollution control, Sewage treatment, Water pollution, Water pollution treatment, Water pollution sources, Pollution abatement, Treatment facilities, Coal mine wastes, Mine drainage, Waste dumps, Municipal wastes, Waste disposal, Waste treatment, Loans, Financing, Interest, State governments, Legislation, Legal aspects, Land reclamation, Reclamation.

Pursuant to a constitutional amendment authorizing the creation of a Land and Water Conservation and Reclamation Fund, provisions are herin made for the adoption of such a fund. Specific criteria are detailed for the financing of bonds, interest rates, and other matters. Money received from the issuance of bonds is herein allocated. The Department of Mines and Mineral Industries is alloted money to be used for the prevention, control, and elimination of stream pollution from mine drainage. The Department is given the authority to enter lands to combat stream pollution where an emergency situation exists. The Department shall also have the authority to construct and operate facilities for the control and treatment of water pollution resulting from mine drainage. The Department may allow coal mine operators to discharge mine drainage into such facilities, for a proper fee. The Department of Health is alloted money to be used for the construction and improvement of municipal sewage treatment plants. The Sanitary Water Board is empowered to adopt such rules and regulations as are necessary to implement the awarding of construction grants to political subdivisions of municipal authorities. (Smiljanich-Florida)
W71-13160

A CITIZEN PANEL FOR ATLANTA AREA STUDIES: FIELD EXPERIMENTATION AND METHODOLOGICAL SUBSTUDIES,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
For primary bibliographic entry see Field 06B.
W71-13166

WATERWORKS AND SEWAGE DISPOSAL.

Michigan Comp Laws Ann secs 325.201 thru 325.214 (1967).

Descriptors: *Michigan, *Sewage disposal, *Water treatment, *Treatment facilities, Water pollution, Water pollution sources, Water pollution treatment, Pollution abatement, Sewage treatment, Waste treatment, Ultimate disposal, Waste disposal, Water purification, Public health, Water supply, Administration, Regulation, Personnel, Management, Legislation, Legal aspects, Permits.

The state health commissioner is given supervisory authority over all sewage treatment and water supply facilities. The commissioner may make and enforce necessary rules and regulations and shall classify water and sewage treatment plants and issue certificates to qualified individuals to operate such facilities. Every included water or sewage treatment plant shall be under the supervision of a properly certified operator. The commissioner may require cleansing of portions of such systems and make structural changes necessary to produce proper operation. All operators of water and sewage treatment plants shall file with the commissioner the plans and specifications of such systems. Before commencing the construction of any treatment facility the operator shall submit the construction plans to the commissioner, who upon approval shall issue a permit for construction. It shall be unlawful to construct any facility until a valid permit has been secured. Provision is made for inspection of the operation of any treatment facility. If any facility is polluting water supplies or if any sewage treatment facility is unlawfully polluting state water resources, the commissioner may order such facility closed. Penalties are prescribed for violations of the act. (Smiljanich-Florida)
W71-13177

OIL POLLUTION LIABILITY AND FINANCIAL RESPONSIBILITY.
Senate, Washington, D.C. Committee on Public Works.
For primary bibliographic entry see Field 05G.
W71-13193

WATER POLLUTION CONTROL LEGISLATION--PART I.
Senate, Washington, D.C. Subcommittee on Air and Water Pollution.
For primary bibliographic entry see Field 05G.
W71-13194

WATER RESOURCE MANAGEMENT IN THE UPPER POTOMAC BASIN.
Interstate Commission on the Potomac River Basin, Harrisonburg, Va.
For primary bibliographic entry see Field 05G.
W71-13195

REGULATIONS AND REQUIREMENTS (DISCHARGE OF WASTES).
Virginia State Water Control Board, Richmond.

Regulations and Requirements, June 1970. 1 p.

Descriptors: *Virginia, *Water pollution control, *Sewage disposal, *Treatment facilities, State governments, State jurisdiction, Pollution abatement, Regulation, Administration, Local governments, Water pollution, Water pollution sources, Administrative agencies, Legal aspects, Water quality control, Wastes, Industrial wastes, Waste treatment, Sewage treatment, Supervisory control (Power).

Every owner discharging untreated sewage into the waters of Virginia shall proceed immediately with the development of a program to reduce the pollution caused by the discharge of such sewage. This program must include the preparation of plans for such treatment plants and facilities as may be necessary. Owners issued a certificate to continue discharging industrial wastes shall proceed immediately with the development of such a program and submit periodic progress reports to the Water Control Board. The Board may not, however, issue certificates for sewage treatment facilities in any locality where the political subdivision has not approved such a facility. The Board must be immediately notified by any certificate holder in the event of any unusual or extraordinary discharge of wastes. An operator of a sewage treatment system servicing more than 400 persons, actually discharging untreated or inadequately treated sewage, and not engaged in a pollution abatement program shall not improve or build new treatment facilities unless

such owner applies for and receives the express authorization of the Board. Nothing herein limits the Board's control over systems serving less than 400 persons. (Horwitz-Florida)
W71-13196

ELEMENTS OF LIABILITY.
American Law Inst.

Restatement of Torts, Interference with Use of Land secs. 822 thru 832 (1939).

Descriptors: *Pollution abatement, *Remedies, *Relative rights, *Reasonable use, Competing uses, Judicial decisions, Air pollution, Water pollution, Riparian rights, Water rights, Waste disposal, Land use, Land tenure, Water utilization, Public health, Public rights, Water pollution effects, Water pollution sources, Real property, Legal aspects.

Non-trespassory invasions of a person's interest in the use and enjoyment of land resulting from the pollution of surface waters, subterranean waters, or waters in watercourses and lakes are governed by the general rules herein detailed. Nontrespassory invasions of a person's interest in the use and enjoyment of land resulting from another's interference with the flow of surface water are also encompasoed by the rules herein detailed. Definitions and illustrations of the rules herein stated are provided. The general rule is that an actor is liable for a nontrespassory invasion of another's interest in the private use and enjoyment of land if: (1) the other has property rights and privileges in respect to the use and enjoyment interfered with; (2) the invasion is substantial; (3) the actor's conduct is the legal cause of the invasion; and (4) the invasion is either intentional or unintentional and actionable under the rules governing liability for negligent, reckless, or ultra-hazardous conduct. Other sections deal with the unreasonableness of invasions, the utility of such conduct, and a balancing of resulting harm and benefit. (Horwitz-Florida)
W71-13197

SEWAGE AND INDUSTRIAL WASTE TREATMENT REQUIREMENTS AND EFFLUENT CRITERIA.
Illinois Dept. of Public Health, Springfield. Sanitary Water Board.

Technical Release 20-22, Div. of Sanitary Engineering, (rev. April, 1968). 10p, 4 tab.

Descriptors: *Illinois, *Industrial wastes, *Municipal wastes, *Standards, *Water quality control, Water pollution control, Waste water treatment, Administrative agencies, Administrative decisions, Regulation, Legal aspects, Permits, Water pollution, Water quality, Pollution abatement, Environmental sanitation, State governments, Water resources, Waste water (Pollution), Waste water disposal, Waste treatment, Waste disposal, Domestic wastes, Treatment facilities.

All industrial facilities for the treatment of deoxygenating waste shall provide at least secondary biological treatment, or advanced waste treatment as herein provided. Required treatment facilities for non-municipal sewage or domestic wastes are enumerated. Maximum allowable chemical concentrations after municipal sewage treatment are listed. Storage facilities for pollutants shall be located so as to minimize any spillage which might result in water pollution. Definitions and requirements are set forth for secondary, tertiary, and advanced treatment facilities. A permit is required for the construction or use of any new or expanded sewage works or any new outlet for the discharge of wastes into the waters of Illinois. Requirements for obtaining such permits are detailed. Further requirements for the treatment of industrial residue and sewage and domestic wastes are set forth. A list of the maximum acceptable concentration of chemicals in municipal sewage treatment plants is provided. (Robinson-Florida)
W71-13198

MERCURY REGULATIONS.
Illinois Pollution Control Board, Springfield.

Regulation R70-5, March 1971. 3 p.

Descriptors: *Illinois, *Water quality control, *Water pollution control, *Water pollution effects, Administrative agencies, pollution abatement, Standards, State governments, State jurisdiction, Water pollution, Water quality, Water pollution sources, Water pollution treatment, Water policy, Waste disposal, Legal aspects, Public health, Industrial wastes, Metals, Waste treatment, Waste identification.

The dangerous nature of mercury pollution requires specific regulation. The water quality standards for all Illinois waters are herein amended to provide that the concentration of mercury or its compounds shall not exceed 0.0005 mg/l at any time. No effluent discharged into state waters or any public sewer system shall include mercury in excess of 0.0005 mg/l at any time. A reporting requirement is established for every person who utilizes in excess of 15 pounds of mercury per year or discharges mercury into the water or any sewer system. All reports must include: the nature of the enterprise, the type and quantity of mercury products and derivatives, the annual total pounds of mercury discharged, and the measures proposed to reduce such discharges. Exemptions are provided in certain cases where the discharge is less than 5 pounds per year. Medicinal or therapeutic uses of mercury are also exempted where the discharge is less than 1/2 pound per year, is made into a public sewer system, and does not cause the sewage treatment plant to exceed standards established for mercury. (Horwitz-Florida)
W71-13199

WATER QUALITY STANDARDS: INTRASTATE WATERS EXCLUSIVE OF INTERSTATE WATERS.
Illinois Sanitary Water Board, Springfield.
For primary bibliographic entry see Field 05G.
W71-13200

POLLUTION: AN INTERNATIONAL PROBLEM NEEDING INTERNATIONAL SOLUTION,
Supreme Court, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-13201

REPORT ON THE FRAMEWORK STUDY.
Nebraska Soil and Water Conservation Commission, Lincoln.

State Water Plan, Publication No 101, May 1971. 268 p, 78 fig, 58 photo, 89 tab.

Descriptors: *Nebraska, *Water resources development, *Planning, *Water management (Applied), Water resources, Financing, Cities, River basin development, Water conservation, Inter-basin transfers, Water quality control, Water pollution, Water pollution control, Industrial wastes, Domestic wastes, Watershed management, Non-structural alternatives, State governments, Administrative agencies, Water supply, Environment, Recreation, Fish, Wildlife.

The Framework Study for the Nebraska State Water Plan is designed to provide efficient development and management of Nebraska's water and related land resources. This report on the Framework Study describes the Plan, its objectives, the organization of planning groups, and the implementation of the Plan. Next, Nebraska is described in detail, including its physical features, natural resources, populace, economy, and environmental relationships. Existing water resources development and problems and future needs and opportunities are considered; pollution problems of municipalities and industries, domestic water supplies, irrigation, water quality control, fish and wildlife, navigation, drainage, environmental quality, outdoor recreation, and electric power are all discussed. A general description is provided of the problems, needs, and basic framework development of thirteen river basins in Nebraska. One section of the report gives concepts for interbasin water transfer, listing areas needing more water and describing various transfer schemes. Discussed with respect to considerations related to future development are: (1) proper plans, (2) funding, (3) institutional consideration, and (4) concerted action. The report is ended with conclusions and recommendations. (Hart-Florida)
W71-13202

UNILATERAL AND MULTILATERAL APPROACHES TO ENVIRONMENTAL PROBLEMS,
For primary bibliographic entry see Field 05G.
W71-13203

INTERNATIONAL LAW AND POLLUTION OF INTERNATIONAL RIVERS AND LAKES,
For primary bibliographic entry see Field 05G.
W71-13204

THE FREEDOM OF THE SEAS: A LICENSE TO POLLUTE,
For primary bibliographic entry see Field 05G.
W71-13205

INTERNATIONAL CONVENTION FOR THE PREVENTION OF POLLUTION OF THE SEA BY OIL, 1954, BETWEEN THE UNITED STATES OF AMERICA AND OTHER GOVERNMENTS.
For primary bibliographic entry see Field 05G.
W71-13206

AMENDMENTS TO THE INTERNATIONAL CONVENTION FOR THE PREVENTION OF THE POLLUTION OF THE SEA BY OIL.
For primary bibliographic entry see Field 05G.
W71-13207

FINAL ACT OF THE INTERNATIONAL LEGAL CONFERENCE ON MARINE POLLUTION DAMAGE.
For primary bibliographic entry see Field 05G.
W71-13208

INTERNATIONAL CONVENTION RELATING TO INTERVENTION ON THE HIGH SEAS IN CASES OF OIL POLLUTION CASUALTIES.
For primary bibliographic entry see Field 05G.
W71-13209

INTERNATIONAL CONVENTION ON CIVIL LIABILITY FOR OIL POLLUTION DAMAGE.
For primary bibliographic entry see Field 05G.
W71-13210

THE EXISTING STATUS OF WATER MANAGEMENT,
For primary bibliographic entry see Field 06A.
W71-13211

SUPERVISION OF OIL, GAS, AND NATURAL DRY GAS WELLS.
Michigan Comp Laws Ann secs 319.1 thru 319.7, 319.18a, 319.18b, 319.51 thru 319.54, 319.58 thru 319.62a (1967), as amended, (Supp 1971).

Descriptors: *Water pollution control, *Michigan, *Oil wells, *Well regulation, *Water pollution sources, Legislation, Legal aspects, State governments, Administrative agencies, Regulation, Wells, Groundwater, Subsurface waters, Mineral waters, Brines, Drilling, Water pollution, Water supply, Natural gas, Fresh water, Aquatic life, Oil industry, Oil fields.

A supervisor of wells position, a supervisor of natural dry gas wells position, and the regulation of waste in both the oil and gas industries and the natural dry gas industry is herein provided for. The supervisor of wells is supplemented with an advisory board and an appeal board. The first of two acts deals with the conservation of oil and gas and provides for the prevention of waste in production. Under this Act, waste encompasses unreasonable damage to underground fresh or mineral waters; natural brines; other mineral deposits; the surface; soils; animal, fish, or aquatic life; and property. The supervisor of wells is specifically empowered to prevent pollution, damage, or the destruction of fresh water supplies. The supervisor of natural dry gas wells has the duty of overseeing the general operation of such wells in order to prevent damage to fresh, brine, or mineral water. He also supervises the plugging of abandoned wells in order to prevent the escape of water from one strata to another. Permit requirements, record keeping requirements, and penalty provisions are set forth. (Johnson-Florida)
W71-13214

SHORELANDS PROTECTION AND MANAGEMENT ACT OF 1970.
Michigan Comp. Laws Ann. secs. 281.631 thru 281.645 (Supp. 1971).

Descriptors: *Michigan, *Shore protection, *Erosion control, *Land use, Legislation, Regulation, Administrative agencies, State governments, Local governments, Legal aspects, Water law, Planning, Zoning, Fish, Wildlife, Environment, Environmental engineering, Erosion, Land management, Beach erosion, Shores, Lake shores, Wildlife habitats, Long-term planning, Marshes, Fish conservation.

The Water Resources Commission shall make an environmental study of shoreland to determine environmental areas, marsh areas, and fish and wildlife habitat areas. A high risk area is an area subject to erosion, and the Commission shall determine if such an area should be regulated or whether certain methods should be utilized to prevent property loss. An environmental area is an area necessary for the preservation and maintenance of fish and wildlife. The Act grants local governments three years to zone any shoreland or land within their jurisdiction. Any zoning ordinance regulating a high risk or environmental area must be approved by the Commission. The Commission is authorized to promulgate regulations for high risk and environmental areas. It may enforce such orders in court. A plan for the use and management of shoreland is to be prepared by the Commission. The Commission must hold public hearings on the plan. The plan shall include an inventory of the physical and man-influenced shoreline features, existing management plans, problems involved with shoreland management, and recommendations for future use and management. Moneys and grants may be received for the purpose of research, planning, or the management of shoreland. (Johnson-Florida)
W71-13221

LIQUID INDUSTRIAL WASTES.
Michigan Comp. Laws Ann. secs. 323.271 thru 323.280 (Supp. 1971).

Descriptors: *Michigan, *Industrial wastes, *Liquid wastes, *Waste disposal, Water pollution, Water pollution sources, Pollution abatement, Water quality control, Industries, Permits, Regulation, Administration, Transportation, Waste dumps, Pollutants, Wastes, Effluents, Sewage treatment, Industrial production, Waste water (Pollution), Ultimate disposal, Legislation, Legal aspects.

Any business removing liquid industrial wastes from the premises of another shall obtain a license from the water resources commission. A surety bond covering the period of the license shall also be obtained to indemnify the commission for the abatement of water pollution resulting from improper disposal of industrial wastes by the licensee. Qualifications for the license are set forth. It shall be unlawful for any person to remove liquid industrial wastes from the premises of another without a proper license and bond. All vehicles used to transport liquid industrial wastes shall carry a license by the commission for inspection by its representative or law enforcement agent. Such license shall issue yearly upon satisfaction of the commission that the vehicle and equipment is proper and adequate for the purpose. Any container of industrial wastes shall be kept tightly closed in transit. A record shall be made of all trips of the vehicle and the point and method of disposal. The commission may order abatement of any pollution resulting from disposal of the waste and may, after proper hearing, revoke the violator's license. Criminal penalties are provided for violations of the act. (Smiljanich-Florida)
W71-13222

SEWAGE DISPOSAL AND WATER SUPPLY.
Michigan Comp. Laws Ann. secs. 323.151 thru 323.162 (1967).

Descriptors: *Michigan, *Treatment facilities, *Water supply, *Financing, Sewage disposal, Sewage treatment, Public health, Government finance, Federal government, State governments, Local governments, Administrative agencies, Grants, Legislation, Legal aspects.

The water resources commission shall be empowered to: (1) encourage the organization of sewage disposal and water supply districts, (2) enter into contracts with governmental units in matters concerning water supply and sewage disposal systems, (3) act as the fiscal agent to make funds available for construction of these systems, and (4) coordinate its functions with related agencies in accomplishing the purposes of this Act. Any two or more municipalities may request the organization of a sewage disposal or water supply district. If the commission, after a hearing, shall determine a need in the interest of public health, it shall organize a referendum to determine whether a majority of the electors desire the district. Upon a favorable referendum, the commission shall encourage the municipalities to incorporate the authority for the purpose of operating the system. Provisions for the district's permanent governing body are enumerated. The district is authorized to: (1) build the systems, (2) investigate new water supply sources, (3) investigate sewage disposal facilities, (4) acquire property, and (5) accept state and federal funds. Additional provisions for construction and financing are enumerated. (Shelnut-Florida)
W71-13223

WATER POLLUTION.
Michigan Comp. Laws Ann. secs. 323.101 thru 323.103 (1967).

Descriptors: *Michigan, *Pollution abatement, *Treatment facilities, *Financing, Sewage treatment, Water pollution, Pollution abatement, Industrial wastes, Government finance, Public health, State governments, Federal government, Grants, Legislation, Legal aspects.

Any public corporation is authorized to accept grants or other aid which the federal government may authorize for distribution to the several states for the construction of public improvements, the purpose of which is to aid in the prevention or abatement of water pollution. Additionally, any public corporation is authorized to accept contributions from industries for the purpose of aiding in the prevention or abatement of water pollution and to enter into contracts with industrial establishments concerning: (1) the collection, treatment and disposal of sewage and industrial wastes; (2) the use by any public corporation of sewage collection, treatment and disposal facilities owned by any industry; (3) the coordination of the sewage collection, treatment and disposal facilities of the public corporation with the facilities of any industry; and (4) when determined by its governing body to be in the public interest and necessary for the protection of the public health, the operation of sewerage facilities to abate water pollution resulting from discharges of industrial wastes by any industrial establishment. (Shelnut-Florida)
W71-13239

DIVISION OF MINERAL RESOURCES.
Massachusetts Ann. Laws, ch. 21, secs. 54 thru 58 (Supp. 1970).

Descriptors: *Massachusetts, *Administrative agencies, *Regulation, *Mineral industry, Mining, Administration, Administrative decisions, Permits, Wastes, Waste disposal, Industrial wastes, Chemical wastes, Water pollution, Water pollution control, Water pollution sources, Water quality, Water quality control, Waste water disposal, Waste water (Pollution).

The Massachusetts Division of Mineral Resources shall: (1) license orderly exploration for mineral resources; (2) lease exclusive rights for extraction of mineral resources discovered; (3) establish charges and fees for licenses and leases to allow a fair profit; and (4) adopt rules and regulations for exploration and extraction of mineral resources to insure proper utilization of such resources consistent with the health, safety, and welfare of the people of Massachusetts. Public notice and hearing must be given before issuing any license or lease. The Division is authorized to cooperate and enter into agreements with other agencies, states, or the federal government. Federal grants may also be received and expended. Persons exploring for mineral resources without a license may be fined and their equipment confiscated. The water resources commission and commissioner of public safety shall sit as a board to insure that chemical and other hazardous wastes are properly handled and disposed of. The board may adopt regulations necessary to protect the public and the environment. Regulations shall also be adopted: (1) identifying hazardous substances, (2) specifying wastes handling, (3) specifying waste disposal locations, (4) establishing reasonable exceptions supported by competent scientific evidence, and (5) setting license and inspection fees. Persons handling and disposing of hazardous wastes without a license are subject to fine and imprisonment. (Hart-Florida)
W71-13240

WATER POLLUTION.
Vermont Stat Ann tit 18, secs 1201 thru 1217 (1968), as amended, (Supp 1971).

Descriptors: *Vermont, *Water supply, *Water pollution control, *Administrative agencies, Water pollution, Water pollution sources, Sewage disposal, Public health, State governments, Local governments, Damages, Legislation, Legal aspects, Regulation, Inspection, Cultivation.

The state board of health shall have the general oversight and care of waters used by municipalities as sources of water supply. The board shall have authority to prohibit the use of water from any source when the same is so contaminated that the public health is endangered. The board may examine state waters to ascertain their purity and fitness for use. Additionally, it may make rules and regulations to prevent water pollution. Provisions are made for: (1) publication of orders and regulations, (2) recommendation of proposed legislation, and (3) operation reports. The board shall advise municipalities and persons from the standpoint of public health concerning the most appropriate sources of water supply and the best methods of insuring water purity. The board may enter any premises to learn whether sources of pollution exist herein, but it shall not prohibit the cultivation of soil if human excrement is not used thereon. Provisions are made for the discharge of sewage into specified bodies of water. The powers of the court of chancery and the imposition of penalties are specified. (Shelnut-Florida)
W71-13259

AMORTIZATION OF POLLUTION CONTROL FACILITIES.
Internal Revenue Service, Washington, D.C.

Federal Register, Vol 36, No 148, p 14183-14184 (July 1971). 2 p.

Descriptors: *Regulation, *Administrative decisions, *Taxes, *Treatment facilities, Water pollution, Water pollution control, Water pollution treatment, Pollution abatement, Water quality, Water quality control, Non-structural alternatives, Waste treatment, Water treatment, Administrative agencies, Financing, Government finance.

Section 1.169-4 of the Income Tax Regulations is amended to extend the time for filing elections to amortize certain pollution control facilities. Where the return for the taxable year in which the first month of the 60 month amortization period falls is filed before November 16, 1971, without making the election, then the election may be made by December 31, 1971, by attaching a statement to an amended return for the taxable year. If no state certifying authority exists, the amended return may be made within 90 days after the authority is established. Amended returns or claims for refunds must also be filed for other taxable years within the amortization period, and subsequent to the taxable year for which the election is made. No other method of election than that prescribed above will be permitted after May 18, 1971, and a taxpayer not electing in the prescribed manner will not be entitled to the deductions. For taxpayers electing before May 18, 1971, the required statement shall be attached to the return for the taxable year including December 31, 1971, or the preceding taxable year. (Hart-Florida)
W71-13353

STATE AND LOCAL PRACTICES IN SOLID WASTE MANAGEMENT,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
W71-13362

MERCED DREDGING CO V MERCED COUNTY (CONSTITUTIONALITY OF ORDINANCE REQUIRING RESTORATION AFTER DREDGE MINING.

67 F. Supp. 598-616 (S.D. Cal. 1946).

Descriptors: *California, *Dredging, *Water pollution control, *Local governments, Water pollution, Water pollution sources, Legislation, Judicial decisions, Legal aspects, Adjudication procedure, Remedies, Public health, Mosquitoes, Mining, Hydraulic mining, Excavation, Mine drainage, Mine wastes, Compensation, Regulation.
Identifiers: *Constitutionality.

Plaintiff dredging company sought to enjoin defendant county from enforcing an ordinance requiring plaintiff to obtain a permit to continue its dredging operation. Defendant moved to dismiss. The ordinance required plaintiff to restore the dredged land to its original condition, which would render plaintiff's operation unprofitable. Plaintiff contended that the ordinance deprived it of property without due process of law, denied plaintiff equal protection, and was taken without compensation. The stated purpose of the ordinance was prevention of mosquito breeding and water pollution and the preservation of soil fertility. Although the federal district court found no rational relation between the ordinance and the control of mosquitoes, and that other laws prevented water pollution, it determined that a reasonable relation could exist between soil preservation and the ordinance. Nevertheless the court found no rational relation between the releveling, indemnity bond, and the five-acre unrestored area requirements of the ordinance and any constitutional objective. Hence defendant's motion to dismiss for failure to state a cause of action was denied, and defendant was enjoined from enforcing the ordinance pending further proceedings, because of the potential irreparable injury to plaintiff. (Hart-Florida)
W71-13375

PAYING FOR POLLUTION BY THE POUND.

Business Week, September 4, 1971, p. 78. 1 p.

Descriptors: *Pollution abatement, *Water pollution control, *Industrial wastes, *Payment costs, Induced costs, Financing, Cost sharing, Cost transfer, Water pollution, Water pollution sources, Water pollution treatment, Treatment facilities, Effluents, Waste water (Pollution), Air pollution, Wastes, Legislation, Environmental effects, Social aspects, Regulation, Legal aspects, Taxes, Tax rate, Non-structural alternatives.
Identifiers: *Effluent charges.

Through stringent regulations, the government is attempting to abate industrial water pollution, but regulation is a time-consuming process. A new approach to supplement governmental standards is rapidly gaining favor: a system of effluent charges levied on industrial pollution. Such pollution charges would provide a strong abatement incentive and would tie environmental costs to the processes that generate pollution One proposal is for a levy of ten cents per pound of pollution, as measured by the biochemical oxygen demand that effluents place on waterways. Such proposals are supported by environmentalists, but are strongly opposed by industry. Industrialists argue that effluent fees will cripple their ability to finance pollution control equipment needed to meet legal standards. Such standards, however, create administrative delay, where-as pollution charges are self-enforcing. Factories could chose between investing in pollution control or paying the effluent fee. The result: high environmental quality at the lowest over-all cost. If the cost of pollution was incorporated directly into market prices, consumers would shift to products with lower environmental costs. Limited experience with effluent charges support the idea. (Smiljanich-Florida)
W71-13415

ENVIRONMENT AND THE QUALITY OF LIFE,
J. Lear.
Saturday Review, May 1, 1971, p 47-53. 7 p, 10 photo.

Descriptors: *Water pollution control, *Administrative agencies, *Waste disposal, *Federal government, Water pollution, Water pollution sources, Water pollution treatment, Treatment facilities, Waste treatment, Sewage treatment, Administration, Regulation, Ultimate disposal, Waste dumps, Legal aspects, History, Planning, Federal jurisdiction, Cities, Municipal wastes, Water quality control.

Although tax money is now being spent in large sums for the construction of new sewage disposal facilities, most such facilities are outdated and contribute to water pollution. Solids separated from the water are not permanently removed as pollutants but are only temporarily set aside. Efforts to redesign and construct new and better waste treatment facilities are herein described. The major work in undertaking field studies of alternatives to existing methods of sewage disposal, in various metropolitan areas, has been assigned to the Army Corps of Engineers. The past history of the Corps is discussed. In recent years, the Corps has been criticized for taking no consideration of the environmental impact of its projects. Major studies are now being made of the feasibility of treating wastes as natural resources and returning them to the earth to contribute to the regeneration of life. The Corps, due to its organizational efficiency and ability to handle interstate matters, has been given responsibility for the study. With this new assignment, the Corps can begin to help restore environmental quality. (Smiljanich-Florida)
W71-13416

MCCOLLUM V. STATE (CRIMINAL LIABILITY OF SUPERVISOR FOR POLLUTION DAMAGE CAUSED BY IMPROPER OPERATIONS OF SUBORDINATES).
305 S.W.2d 612-614 (Crim App. Tex. 1957).

Descriptors: *Texas, *Water pollution sources, *Management, *Oil, Employment, Employee relations, Water pollution, Water Quality control, Water pollution control, Pollution abatement, State governments, Water pollution effects, Reservoir storage, Oil reservoirs, Oil industry, Oil wastes, Storage, Industrial wastes, Damages, Judicial decisions, Legal aspects.

Defendant vice-president of a tank storage depot was convicted of violating a statute prohibiting pollution of public waters. The state claimed that defendant was in charge of operations of the plant and that on two occasions oil escaped into public waters because of defective or improper operation of machinery. Defendant denied knowledge of the escaped oil and contended that the could not be held personally liable without some showing of his connection with the pollution or the maintenance or operation of the machinery. The Court of Criminal Appeals of Texas, reversing a lower court conviction of defendant, noted that defendant had delegated duties to his subordinates. A supervisor is not criminally liable for water pollution damage where improper operation of machinery by subordinates causes pollution. There must be a showing of personal connection between the supervisor and the defective opeation in question in a manner recognized by law, whereby one may be held criminally liable for the acts of others. The state was not foreclosed, however, from proceeding against the corporation itself for the pollution violation. (Smiljanich-Florida)
W71-13437

SEWAGE TREATMENT FACILITIES, STATE GRANTS.
Michigan Comp. Laws Ann. secs. 323.111 thru 323.128 (1967) as amended (Supp. 1971).

Descriptors: *Michigan, *Financing, *Treatment facilities, *Pollution abatement, Water pollution, Water pollution control, Government finance, Sewage disposal, Grants, Local governments, State governments, Administrative agencies, Legislation, Legal aspects, Participating funds.

A fund is established to assist public bodies having jurisdiction over sewage disposal in financing the construction of treatment works. Proceeds from the sale of bonds shall be deposited in the fund. Disbursements from the fund shall be made for specific eligible treatment works projects. Provisions for distribution and maximum amounts for distribution are specified. Grants shall be funded from the fund for treatment works projects in descending order of priority, as established by the water resources commission. The commission shall also promulgate rules to carry out the purposes of this act. A grant shall not be made until the recipient local agency has submitted a comprehensive long-range plan for pollution control within its area. The required content of such official plans is detailed. A procedure for establishing the priority of eligible projects and for certifying projects for allocation of grants is established. A point system is designed to give equal weight to financial needs and water pollution control needs. Total priority points for a project shall be the sum of the points assigned for each need. The commission shall encourage the abatement of unlawful water pollution . 9shelnut-Florida)
W71-13507

PESTICIDE CONTROL BOARD.
New York Public Health Law, secs 1601 thru 1609 (McKinney 1971).

Descriptors: *New York, *Pesticides, *Application methods, *Supervisory control (Power), Pest control, Pesticide residues, Control, Integrated control measures, Water pollution control, Coordination,

Regulation, Administrative agencies, Public health, Environmental effects, Water pollution, Public benefits, Legislation, Legal aspects.

To protect public health and minimize the potential pesticide hazard to man and his environment, consistent with the public interest in the benefits derived from the safe and scientific application of pesticides, a pesticide control board is established to formulate over-all policy and coordinate state efforts at controlling pesticide use. An organizational plan and operational procedures for the board are specified. The board's duties and powers include: (1) formulating an over-all policy for regulating use, transportation, storage and disposal of pesticides; (2) initiating necessary research and investigations; (3) holding public hearings; (4) compiling pesticide information; (5) advising and assisting state agencies in pesticide problems; (6) informing the public about pesticides; (7) recommending prohibitions against specific pesticides; (8) cooperating with federal and state agencies; and (9) accepting and administering loans and grants. In achieving its purposes, the board may request necessary cooperation from other departments. (Gallagher-Florida)
W71-13511

WENDTLANDT V. NATIONAL CO-OPERATIVE REFINERY ASS'N (SALT WATER INTRUSION RESULTING FROM OIL DRILLING OPERATIONS).
215 P. 2d 209-215 (Kan. 1950).

Descriptors: *Kansas, *Saline water intrusion, *Oil wastes, *Remedies, Water pollution, Judicial decisions, Relative rights, Legal aspects, State governments, State jurisdiction, Oil industry, Saline water, Subsurface waters, Groundwater, Percolating waters, Drilling, Oil wells, Water supply, Farms, Water pollution effects, Water pollution sources, Damages.

Plaintiff landowner sought to recover actual and punitive damages for permanent injury to her land caused by salt water from defendant's oil drilling operations. Defendant operated several oil wells on plaintiff's land pursuant to a lease arrangement. The oil wells produced over 5000 barrels of salt water per month. Defendant disposed of this by pumping it into a large pit with a capacity of 3,500 barrels. Defendant knew the salt water was seeping into the soil, yet took no corrective action. Portions of plaintiff's land became polluted by salt water and useless for agricultural purposes. Plaintiff alleged that the value of her land had been permanently decreased by $6000. Plaintiff was awarded $1092 in permanent damages and $5000 in punitive damages. Defendant appealed, contending that the evidence was insufficient to warrant punitive damages. The Supreme Court to Kansas affirmed the judgment on condition that the punitive damages be reduced to $2500. The court held that punitive damages are permissible where a defendant intentionally empties salt water on a plaintiff's land, knowing it would cause serious damage. (Horwitz-Florida)
W71-13521

LEWIS V. CITY OF POTOSI (DAMAGE TO RIPARIAN FROM MUNICIPAL SEWAGE DISPOSAL).
317 S. W. 2d 623-630 (Ct. App. Mo. 1958).

Descriptors: *Missouri, *Eminent domain, *Sewage disposal, *Municipal wastes, Water pollution, Riparian rights, Judicial decisions, Relative rights, State governments, Local governments, Water pollution control, Water pollution sources, Water pollution effects, Farms, Remedies, Damages, Legal aspects, Adjudication procedure, Sewage bacteria, Sewage treatment, Sewage lagoons.

Plaintiff riparian owner sought to recover damages for injury to his land and cattle from defendant municipality. Plaintiff's farm was located downstream from defendant's sewage disposal plant. Water from the plant's settling lagoon drained into a creek which flowed through plaintiff's property. Plaintiff contended that the defendant's actions polluted the creek thereby causing damage to his livestock and permanently reducing the value of his farm. Defendant contended the action was barred by the statute of limitations. The trial court awarded judgement to the plaintiff, and defendant appealed. The St. Louis Court of Appeals reversed and remanded for a new trial on two grounds. First, although the action was not barred by the statute of limitations, the trial court incorrectly gave an instruction which had the effect of extending the time period of the statute. Secondly, the action was, in effect, an eminent domain proceeding rather than a nuisance proceeding and as such only permanent damages to real estate may be recovered. Therefore, the court ruled that injury to plaintiff's cattle was not recoverable as an independent item of damage. (Horwitz-Florida)
W71-13529

PRESENT STATUS OF WATER POLLUTION CONTROL IN JAPAN,
Japan Public Nuisance Lab., Tokyo.
For primary bibliographic entry see Field 05G.
W71-13533

PICKENS V HARRISON (JURY INSTRUCTIONS IN SUIT FOR DAMAGES TO IRRIGATION WELL CAUSED BY SALT WATER POLLUTION FROM OIL WELL).

252 S.W. 2d 575-586 (Tex. 1952).

Descriptors: *Texas, *Oil wells, *Brine disposal, *Water pollution effects, Water pollution sources, Irrigation wells, Water pollution, Water pollution control, Pollututants, Pollution abatement, Saline water, Rice crops, Oil wastes, Oil fields, Waste disposal, Oil industry, Damages, Water quality control, Irrigated land, Groundwater movement, Judicial decisions, Legal aspects.

Plaintiff landowners sued defendant oil well owner to recover damages to their lands caused by salt water pollution of irrigation water. Plaintiffs contended that defendant had negligently allowed salt water from his oil well operations to seep into their lands, thereby polluting an irrigation well and ruining their rice crops. Defendant denied liability and objected to the jury instructions. Defendant contended that the central issue, proximate cause, should have been separately included in each instruction, and that the instructions allowed double recovery for a part of the damages. In affirming in part a jury verdict and judgment for plaintiffs, the Supreme Court of Texas noted that proximate cause had been explained to the jury in a separate instruction. In an action for damages caused by water pollution, it is not necessary that proximate cause be included in each separate jury instruction. The court held, however, that where one instruction permitted the jury to consider all damages done, and another instruction permitted the jury to consider damage to the rice crop for one year, the instructions were erroneous, since they permitted double recovery. Judgment was affirmed as modified. (Smiljanich-Florida)
W71-13534

BOARD OF COMMISSIONERS OF LAKE COUNTY V. MENTOR LAGOONS, INC. (PRIVATE LANDOWNERS REMEDIES AGAINST COUNTY COMMISSIONERS MAINTAINING A NUISANCE).
216 N. E. 2d 643-647 (C. P. Lake County Ohio 1965).

Descriptors: *Ohio, *Sewage treatment, *Pollution abatement, *Local governments, Water pollution control, Water quality control, Judicial decisions, Legal aspects, Water law, Water Pollution, Water pollution sources, Water quality, Environmental sanitation, Sewage disposal, Local governments, Sanitary engineering, Sewers, Eminent domain, Damages.
Identifiers: Injunction (Prohibitory), Lake Erie.

Plaintiff board of county commissioners brought an action seeking an easement over defendant's land for a sewer line. Defendant owned a marina on Lake Erie. Defendant filed a cross petition seeking damages for breach of contract and an injunction against the maintenance of a public nuisance. The discharge of inadequately treated sewage into Lake Erie constituted the alleged nuisance. Plaintiff maintained that a board of county commissioners is not subject to liability for damages and that defendant had no cause of action for an injunction. The Court of Common Pleas of Lake County Ohio held that a board of county commissioners is not liable for damages for negligence or nuisance. However, the court ruled that a littoral owner may enjoin a board of county commissioners from maintaining a public nuisance consisting of an improperly functioning sewage plant. The court upheld the demurrer as to damages and overruled the demurrer to the injunction. (Robinson-Florida)
W71-13536

POLZIN V. NATIONAL CO-OP REFINERY, (OIL POLLUTION OF DEEP WATER WELL).

266 P. 2d 293-298 (Kan. 1954).

Descriptors: *Kansas, *Deep wells, *Oil wells, *Damages, Water pollution, Water pollution sources, Water wells, Water sources, Oil, Oil industry, Oily water, Drill holes, Judicial decisions, Legal aspects, Remedies.

Plaintiff landowner sued defendant oil companies for the pollution of a deep water well. Within a short distance of plaintiff's water well, one defendant operated an oil well, while the other operated a saltwater disposal well. Plaintiff's water well became contaminated, and he contended that the pollution occurred by reason of the faulty construction and operation of one defendant's disposal well and the faulty drilling and casing of the other's oil well. The combined conduct of the defendants, he contended, was the sole cause of the pollution. Defendants contended that there was no community of wrongdoing and that the damage was caused by an independent intervening agency. The Supreme Court of Kansas held that concurrent, as distinguished from joint, negligence arises where the injury is proximately caused by the concurrent wrongful acts of two or more persons acting independently. Additionally, where injury to an innocent party would not have occurred except for the concurrent of others, those whose acts unite in producing the injury will be held jointly and severally liable to the injured party for the entire damage. (Shelnut-Florida)
W71-13538

KENDALL V. SHARP (DAMAGE RESULTING FROM POLLUTION OF STREAM AND GROUNDWATER AS A RESULT OF LUMBER MILL OPERATIONS).
293 P. 2d 803-805 (Dist. Ct. App. Cal. 1956).

Descriptors: *California, *Industrial wastes, *Water supply, *Lumbering, Water pollution, Waste disposal, Riparian rights, Relative rights, Legal aspects, State governments, State jurisdiction, Remedies, Damages, Water pollution effects, Water pollution sources, Judicial decisions, Artesian wells, Drainage systems, Farms, Mills.

Plaintiff riparian owner sought to recover damages for the depreciation in property value resulting from the operations of defendant lumber mill company. Defendant drained contaminated waters from a mill pond into a creek upstream from plaintiff's farm. Shortly thereafter, the creek and plaintiff's well became noticeably discolored and so offensive in taste and smell that the water could not be used for household purposes. Plaintiff contended that the pollution resulted from defendant'

drainage operations. Defendant contended the evidence did not show that the pollution was caused by its actions and that such drainage was a normal use of the creek in an industrial area. The California District Court of Appeal, Third District, affirmed a judgement for plaintiff and held that even if an area is industrial in nature, a lumber mill has no right to drain water from a contaminated mill pond into a creek without being held responsible for the damages done a downstream riparian. Ruling that the evidence clearly preponderated in favor of plaintiff, the court affirmed the lower court's judgement. (Horwitz-Florida)
W71-13539

AKIN AND DIMOCK OIL CO. V. STATE (NEGLIGENCE AND CRIMINAL INTENT ELEMENTS OF STATUTE PROHIBITING POLLUTION).
243 P.2d 384-389 (Crim. App. Okla. 1952).

Descriptors: *Oklahoma, *Water pollution sources, *Oil wells, *Remedies, Water pollution control, Water quality control, Oil wastes, Judicial decisions, Legal aspects, Legislation, Water policy, Water pollution, Water pollution effects, Water quality, Oil, Oil fields, Oil industry, Oily water, Adjudication procedure.

Defendant oil company was prosecuted for polluting a public stream with crude oil, in violation of a statute. Defendant maintained that the statute created only a personal liability and required a showing of negligence or intent. The jury rendered a verdict of guilty. The Criminal Court of Appeals of Oklahoma affirmed and held that: (1) the term person, under an Oklahoma pollution statute, includes firms, corporations, associations, principals, agents, or employees; (2) criminal intent and negligence are not elements of the offense; and (3) the state is only required to show that the deleterious substances mentioned in the statute were in the control of, or belonged to the accused, and got into public waters. The conviction was sustained on grounds that the evidence established defendant's ownership of oil wells from which the crude oil escaped.
W71-13546

LOUISIANA COASTAL COMMISSION.
Louisiana Revised Code secs 34:2251 thru 34:2253.1 (1971 Supp.).

Descriptors: *Louisiana, *Administrative agencies, *Treatment facilities, *Navigation, Water pollution control, Water pollution, Water quality, Water quality control, Taxes, Waste water (Pollution), Saline water intrusion, Channels, Water supply, Salt water-freshwater interfaces, State governments, Floods, Drainage, Industrial wastes, Domestic wastes, Locks, Canals, Levees, Barriers, Encroachment, Estuaries.

The Louisiana Coastal Commission is an eighteen member board empowered to plan, establish, construct, operate, and maintain: (1) a system of navigation channels, including locks; (2) a fresh water supply system; (3) domestic and industrial water controls to prevent pollution; (4) levees and barriers to prevent salt water intrusion; and (5) a drainage system to prevent flooding. The Commission has eminent domain powers and all powers of a corporation. The Louisiana Coastal Commission Advisory Committee, with nine members, participates in the Commission's executive meetings in an advisory capacity, without voting powers. Upon two-thirds approval of its membership, the Commission is authorized to levy ad valorem taxes not exceeding 20 mills, subject to approval by a majority of freeholders in the affected area. (Hart-Florida)
W71-13562

REGIONAL WATER RESOURCES PLANNING IN SOUTH AFRICA,
For primary bibliographic entry see Field 06B.
W71-13579

RUSCH V PHILLIPS PETROLEUM CO. (LIABILITY OF OIL COMPANIES FOR POLLUTING UNDERYLING STRATA),
180 P.2d 270-278 (Kan. 1947).

Descriptors: *Kansas, *Cattle, *Oil wastes, *Water supply, Water pollution, Water pollution effects, Water pollution sources, Impaired water quality, Water quality, Legal aspects, Leases, Oil industry, Brine, Saline water, Oil, Livestock, Judicial decisions, Adjudication procedure, Legislation, Damages, Remedies, Pollutants, Water wells, Injection wells, Groundwater, Ponds.

Plaintiff leaseholder/cattle rancher sought to recover damages from defendant oil companies for injury to his cattle and leasehold caused by water pollution. Defendants permitted their brine and oil wastes to enter the fresh water strata and plaintiff's water supply on an adjacent tract was rendered unfit for livestock. Following a mistrial, defendants appealed from an order overruling their demurrer. The Kansas Supreme Court reviewed the evidence presented and concluded that it properly presented a question for the jury. Defendants also contended that plaintiff did not establish a proper measure of damages. The court, however, determined that the evidence sufficiently established that the use of plaintiff's leasehold was impaired. Furthermore, defendants contended that no basis for punitive damages was in the evidence. Since a statute prohibited, and made criminal, the act of permitting oil wastes and brine to escape the immediate drilling area, and since defendant apparently knew the pollutants were escaping, the court held that the jury might properly find wanton and reckless conduct by defendants, warranting punitive damages. (Hart-Florida)
W71-13593

GULF OIL CORP V. MILLER, (OIL POLLUTION OF DAIRY DRINKING WATER).
175 P.2d 335-338 (Okla. 1946).

Descriptors: *Oklahoma, *Water pollution effects, *Salinity, *Cattle, Water pollution, Dairy industry, Milk, Oil wastes, Impaired water quality, Pollutants, Remedies, Damages, Judicial decisions, Legal aspects, Salts.

Plaintiff dairy operator sought damages for injury and death to his milk cows, loss of milk, and the value of aborted calves alleged to have occurred by reason of drinking water from a creek which had been polluted by defendant corporation in the operation of its oil and gas leases. It was established that the creek which flowed through plaintiff's pastures was heavily polluted, that salt water from at least three of defendant's wells flowed into the creek, that four cows which died were seen drinking from this creek, and that the cows died from drinking salt water. Expert testimony was offered by plaintiff tending to show that drinking salt water would also cause weakness, loss of milk production, and abortion of calves. Defendant contended that no causal connection was shown between the alleged negligence and the injury sustained to support the jury verdict for plaintiff. The Supreme Court of Oklahoma affirmed, holding that the evidence was sufficient to show a causal connection between the negligence of defendant and the injury sustained. (Shelnut-Florida)
W71-13595

STANOLIND OIL AND GAS CO. V. CARTWRIGHT (DAMAGE TO LAND AND LIVESTOCK BY SURFACE OIL POLLUTION).
198 P.2d 737-740 (Okla. 1948).

Descriptors: *Oklahoma, *Oil industry, *Surface runoff, *Oil wastes, Legal aspects, State governments, State jurisdiction, Damages, Remedies, Legislation, Relative rights, Oil, Water pollution sources, Oily water, Waste disposal, Rainfall, Surface drainage, Adjudication procedure.

Plaintiff landowners sought to recover damages from defendant oil company for injury to land and personal property thereon. Plaintiff's land was contiguous to a laboratory used by defendant for research on oil products. During a rainfall, oil and other deleterious substances escaped from the laboratory and flowed onto plaintiff's land, killing vegetation and chickens. Plaintiffs' alleged that defendant negligently allowed the oil to flow over their land. The trial court entered a judgment for plaintiffs and defendant appealed. Defendant contended that plaintiffs had not directly proven that the oil was deleterious in nature and had failed to show that such oil was the proximate cause of the injuries sustained. The Supreme Court of Oklahoma held that the deleterious nature of oil and other substances escaping onto another's land need not be proven directly if the effects of such substances are shown to be harmful. The court ruled that the evidence showing plaintiffs' injuries was competent and material to determine the proximate cause of the injury. The judgment for plaintiffs was affirmed. (Horwitz-Florida)
W71-13637

HAVEMAN V BEULOW (POLLUTION OF WATERWELL).
317 P. 2d 313-317 (Wash. 1950).

Descriptors: *Washington, *Water pollution sources, *Damages, *Water well, Impaired water quality, Under seepage, Water pollution, Industrial wastes, Pollutants, Infiltration, Groundwater movement, Subsurface movement, Consumptive use, Domestic water, Pollution abatement, Judicial decisions, Legal aspects, Remedies, Wells, Dikes, Shallow wells.
Identifiers: Injunction (Prohibitory).

Plaintiff landowners sought to recover damages resulting from the pollution of his water well by refuse matter from defendant's dehydrating plant operation. Plaintiffs also sought injunctive relief. The well, funishing water for domestic purposes, was located on plaintiffs' land. The Defendant constructed an open sump, diked on the southerly and westerly sides. Such dikes allowed refuse to accumulate in the sump. Subsequently, plaintiffs noticed a marked change in the quality of their well water. Defendant contended that the refuse in the sump had nothing to do with the contamination of the well. The Supreme Court of Washington held that where damages are sought for the pollution of a water well through seepage from an adjacent waste sump, a plaintiff must prove that the defendant's conduct caused the pollution. Where injury resulting from the pollution of a farm's water supply is permanent, the plaintiff can recover the difference in fair market value before and after the injury. Finding the measure of damages and the granting of injunctive relief by the lower court to be proper, the court affirmed the judgement for plaintiffs. (Shelnut-Florida)
W71-13645

AN ECONOMIC ANALYSIS OF ORGANIZATIONS OF WATER USERS,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 06B.
W71-13657

WATER POLLUTION CONTROL, RIVER BASIN AUTHORITIES, AND ECONOMIC INCENTIVES: SOME CURRENT POLICY ISSUES,
Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-13659

RULES FOR CONFINED FEEDING OPERATIONS WASTE WATER DISPOSAL.
Iowa Water Pollution Control Commission, Des Moines.
For primary bibliographic entry see Field 05G.
W71-13660

THE EMERGENT RIGHT TO A DECENT ENVIRONMENT,
National Science Foundation, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-13662

THE ALICE-IN-WONDERLAND WORLD OF STANDING,
Biggs, Strayer, Stoel, and Boley, Portland, Oreg.
For primary bibliographic entry see Field 05G.
W71-13663

THE RELATIONSHIP BETWEEN FEDERAL AND STATE LAWS TO CONTROL AND PREVENT POLLUTION,
For primary bibliographic entry see Field 05G.
W71-13664

PUBLIC LAND POLICY AND THE ENVIRONMENT, VOLUME 1, PART 1: THE LEGAL AND ADMINISTRATIVE FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT OF THE PUBLIC LANDS,
Public Land Law Review Commission, Washington, D.C.
I. M. Heyman, and R. H. Twiss.
Available from the National Technical Information Service as PB-196 168, $3.00 in paper copy, $0.95 in microfiche. December 1970. 257 p, 2 fig, 1 chart, 580 ref.

Descriptors: *Administrative agencies, *Land resources, *Water pollution control, *Environmental sanitation, Legislation, Administration, Regulation, Federal government, Planning, Land management, Public lands, Land use, Natural resources, Forest management, Range management, Recreation, Mining, Grazing, Water pollution, Air pollution, Environment.

This report describes and analyzes the legal and administrative systems utilized by three major land management agencies for coping with the consequences of environmental degradation. The focus is primarily on agency authority over environmental matters and agency directives that provide the planning and management systems for anticipating environmental harms and seeking to ameliorate or prevent them. A study of the planning and management of the Forest Service as to timber, recreation, use and occupancy, and mining is presented. The Bureau of Land Management's management of minerals and energy, land and realty, grazing, and timber use is examined. The authority, planning system, and resource management procedures of the National Park Service are provided. The study also evaluates the impact of certain federal environmental quality laws on management of public land. (Robinson-Florida)
W71-13665

POLLUTION--THE RISK AND INSURANCE PROBLEM,
Ebasco Services, Inc, Chicago, Ill.
For primary bibliographic entry see Field 05G.
W71-13666

A POLLUTION SUIT: LAWYER'S GUIDE TO PRIVATE LAW THEORY,
Loyola Univ., Chicago, Ill. School of Law.
R. E. Burns.
Trial Lawyer's Guide, Vol 15, No 2, p 191-251, May 1971. 60 p, 71 ref, 2 append.

Descriptors: *Adjudication procedure, *Remedies, *Pollution abatement, *Public rights, Water pollution, Water quality control, Water pollution sources, Public health, Air pollution, Environmental sanitation, Social aspects, Riparian rights, Legislation, Judicial decisions, Regulation, Administration, Administrative agencies, Jurisdiction, Legal aspects, Reasonable use, Relative rights.

This guide to the use of private citizen suits to abate pollution acquaints attorneys with the practical problems involved. An individual's right to public relief is discussed. The trend favors according individuals or classes requisite access to judicial review of action or inaction in the administration of federal and state anti-pollution laws. The most common theories utilized in civil suits seeking damages or an injunction are discussed. In a private action against a public nuisance, the damage alleged must be different in kind, not merely degree. Private nuisance and negligence theories are compared. Nuisance, unlike negligence, centers attention on the injury-producing conditions, not the actor's morals or state of mind. The use of strict liability theories is explored. Where public health is endangered through deleterious products, modern risk distribution apportions to the vendor, on a strict liability basis, the economic consequences. A bibliography of materials relating to pollution legislation, rules, regulations, and case law is provided. Various legal forms relating to a recent major water pollution suit are reproduced as examples of the law in action. (Smiljanich-Florida)
W71-13667

INTERNATIONAL ENVIRONMENTAL SCIENCE.
Proceedings of the Joint Colloquium Before the Comm. on Commerce, U.S. Senate, and the Comm. on Science and Astronautics, House of Representatives, 92d Cong, 1st Sess, May 25, 26, 1971. 241 p, 2 fig, 1 map, 2 chart, 7 append.

Descriptors: *Environment, *Research and development, *Coordination, *Foreign countries, Environmental effects, Ecology, Air pollution, Water pollution, Legal aspects, Foreign research, Water pollution control, Water quality control, Pollution abatement, Organizations, Conferences, Data collections, Federal government, International law, Non-structural alternatives, Population.

Human ecology is global in nature and human survival depends ultimately upon the cooperative effort of the entire human species. The Joint Colloquium on International Environmental Science, therefore, proposed a senate resolution recommending the creation of a World Environmental Institute to act as a global research center to disseminate knowledge of environmental problems and their solutions. The proceedings of the Colloquium contain statements and factual analyses by environmental scientists from the United States, Great Britain, Singapore, India and Sweden. These statements relate to the present state of environmental problems and the need for international action. A proposed senate resolution relating to the creation of a World Environmental Institute is set forth. Appendixes contain biographical sketches of Colloquium participants, a report on the human environment in the United States, a report on environmental problems in India, a taxonomy of international environmental problems, and other reports relating to environmental problems. (Gallagher-Florida)
W71-13668

INTERSTATE ENVIRONMENT COMPACT.
Senate, Washington, D.C. Committee on the Judicary.
For primary bibliographic entry see Field 05G.
W71-13669

CONTEMPORARY STUDIES PROJECT: IMPACT OF LOCAL GOVERNMENTAL UNITS ON WATER QUALITY CONTROL.
For primary bibliographic entry see Field 05G.
W71-13670

DOCUMENTS ON THE USE AND CONTROL OF THE WATERS OF INTERSTATE AND INTERNATIONAL STREAMS--COMPACTS, TREATIES, AND ADJUDICATIONS,
House of Representatives, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-13671

WATER QUALITY STANDARDS (INTERSTATE WATERS, OHIO RIVER AND SALINE RIVER).
Illinois Sanitary Water Board, Springfield.
For primary bibliographic entry see Field 05G.
W71-13672

WATER QUALITY STANDARDS.
Virginia State Water Quality Control Board, Richmond.
For primary bibliographic entry see Field 05G.
W71-13674

FEDERAL POLLUTION CONTROL: PARTICIPATION BY STATES AND INDIVIDUALS ENHANCES THE NATIONAL POLLUTION CONTROL EFFORT,
For primary bibliographic entry see Field 05G.
W71-13675

FEDERAL-STATE RELATIONSHIPS IN CALIFORNIA WATER QUALITY CONTROL,
California State Water Resources Control Board, Sacramento.
For primary bibliographic entry see Field 05G.
W71-13676

WASTE DISCHARGE REPORTS AND REQUIREMENTS.
Califrnia State Water Resources Control Board, Sacramento.
For primary bibliographic entry see Field 05G.
W71-13677

CERTIFICATION OF CONFORMANCE WITH WATER QUALITY STANDARDS.
California State Water Resources Control Board Sacramento.
For primary bibliographic entry see Field 05G.
W71-13678

DISPOSAL OF INDUSTRIAL WASTES.

Oregon Administrative Rules Compilation, ch 340, secs 43-005 thru 43-025 (1970).

Descriptors: *Oregon, *Industrial wastes, *Waste disposal, *Pollution abatement, Water pollution, Ultimate disposal, Regulation, Administrative agencies, Liquid wastes, Organic wastes, Solid wastes, Pollutants, Waste water disposal, Legislation, Legal aspects, Farm wastes, Confinement pens, Hogs, Cattle, Canneries, Industrial plants, Foods, Poultry, Livestock.

Unless the Department of Environmental Quality provides an exemption, all fruit and vegetable processing plants shall provide efficient facilities to remove all suspended and floating materials from the wastes resulting from canning and freezing processing. All solids retained by a standard twenty mesh screen shall be removed from liquid wastes by screening or other approved method and disposed of in a non-polluting manner. Wastes from slaughterhouses and meat packing plants shall be disposed of in a manner that will prevent direct or indirect entry into public waters. All blood shall be collected and disposed of separately from other wastes. Manure and hog stomach contents shall be collected separately and used as fertilizer, land-fill, or in some other approved manner. All fleshings, grease particles, hair and other solid materials shall be collected by dry cleaning of floors and by screening of wastes. Adequate grease recovery basins shall be installed. Similiar provisions govern the disposal of wastes in poultry killing and packing plants. To prevent water pollution from solid wastes, hog feeding yards and holding pens shall be constructed so that they can and will be dry cleaned before being washed down. (Gallagher-Florida)
W71-13679

PREVENTING THE POLLUTION OF FRESH WATER BY OIL, GAS, AND SALT WATER.
Louisiana State Dept of Conservation, Baton Rouge.
For primary bibliographic entry see Field 05G.
W71-13680

WATER QUALITY STANDARDS (INTERSTATE WATERS, CHICAGO RIVER AND CALUMENT RIVER SYSTEM AND CALUMET HARBOR BASIN).
Illinois Sanitary Water Board, Springfield.
For primary bibliographic entry see Field 05G.
W71-13681

OPERATION REPORTS.
Illinois Sanitary Water Board, Springfield.

Technical Release 20-2, Sanitary Water Bd. Illinois Dept. of Public Health, Div. of Sanitary Engineering, Bureau of Stream Pollution Control. Sept. 1965, 10 p.

Descriptors: *Illinois, *Water pollution control, *Regulation, *Administrative agencies, Legislation, State governments, Water pollution, Sewage disposal, Waste disposal, Domestic wastes, Industrial wastes, Treatment facilities, Biochemical oxygen demand, Solid wastes, Dissolved oxygen, Chlorination, Organic matter, Sludge, Sludge disposal, Rainfall, Temperature.

The Illinois Sanitary Water Board has established regulations requiring operation reports disclosing: (1) the volume or characteristic of waste discharges; (2) efficiency of operation of a sewage works; and (3) the effects of discharges upon state waters. The reports must be submitted by all sewage works or industrial waste facilities which: (1) handle organic wastes; (2) handle inorganic wastes which are toxic or otherwise objectionable; or (3) treat industrial wastes. The reports are required monthly on forms furnished by the Board. Failure to submit proper reports includes data as to: (1) rainfall, (2) wind, (3) temperature, (4) streamflow, (5) raw sewage temperature, (6) sewage flow, (7) recirculated flow, (8) suspended solids, (9) settleable solids, (10) sludge volume index, (11) dissolved oxygen, (12) return sludge, (13) suspended sludge, (14) primary sludge, (15) digestion, (16) chlorination, (17) electric current, (18) biochemical oxygen demand, (19) suspended solids, (20) raw sewage pH and (21) relative stability.
W71-13682

RULES AND REGULATIONS FOR PUBLIC WATERWORKS PROJECTS.
Texas State Dept. of Health, Austin. Div of Sanitary Engineering.
For primary bibliographic entry see Field 05G.
W71-13683

LIABILITY OF CORPORATIONS AND CORPORATE OFFICERS FOR PUBLIC WELFARE OFFENSES: THE WATER POLLUTION PROBLEM,
For primary bibliographic entry see Field 05G.
W71-13684

STANDARDS OF QUALITY FOR PUBLIC WATERS OF OREGON AND DISPOSAL THEREIN OF SEWAGE AND INDUSTRIAL WASTES.
For primary bibliographic entry see Field 05G.
W71-13685

THE OIL AND GAS INDUSTRY AND WATER CONSERVATION,
For primary bibliographic entry see Field 05G.
W71-13686

A PRACTITIONER LOOKS AT POLLUTION,
Gulf Oil Corp; Houston, Tex.
For primary bibliographic entry see Field 05G.
W71-13687

OIL POLLUTION CONTROL RULES AND REGULATIONS.

Rhode Island Department of Health, Providence, Rhode Island, 1971. 8 p.

Descriptors: *Rhode Island, *Oil wastes, *Water pollution sources, *Water pollution control, Water pollution, Water quality control, Regulation, Oil industry, Oil, Storage tanks, Oily water, Storm runoff, Public health, Administrative agencies, Waste water treatment, Water pollution treatment, Waste water disposal, Ships, Inland waterways, Harbors, Rivers, Legal aspects, Legislation.

To prevent the discharge or escape of any petroleum product into the waters of the state, Rhode Island's Department of Health promulgates these regulations. Basically, the regulations prohibit any discharge including storm runoff of any oil product into state waters from any oil refinery, tank farm, or other manufacturer of petroleum products. Oily waste water can be discharged into state waters only after proper treatment. Other regulations prohibit the: (1) storing of oil on any bank, shore, wharf or pier where it is likely to escape during a storm; (2) pumping of bilge or ballast water from any vessel into any harbor, river, bay or other inland waterway; and (3) improper loading or unloading of oil on or from any vessel. Specific loading, unloading and ballasting procedures for oil tankers are established. Additional provisions set specific procedures and prohibitions for the operation of oil storage tank farms. Every person who handles oil shall, when a spillage of oil occurs on his premises, take steps as promptly as possible to prevent the spilled oil from reaching a public sewer or drain or any way entering any of the waters of the state. (Gallagher-Florida)
W71-13688

WATER QUALITY STANDARDS.
For primary bibliographic entry see Field 05G.
W71-13689

OFFSHORE OPERATIONS,
Liskow and Lewis, New Orleans, La.
For primary bibliographic entry see Field 05G.
W71-13690

THE MINING INDUSTRY AS A WATER USER AND WATER POLLUTER--LEGAL ASPECTS,
Parsons, Behle and Latimer, Salt Lake City, Utah.
For primary bibliographic entry see Field 05G.
W71-13691

OREGON'S WATER POLLUTION CONTROL PROGRAM.
Oregon State Dept. of Environmental Quality, Portland.
For primary bibliographic entry see Field 05G.
W71-13692

WASTE DISPOSAL.
For primary bibliographic entry see Field 05G.
W71-13693

WATER QUALITY STANDARDS APPLICABLE TO NEBRASKA WATERS.
Nebraska State Dept. of Health, Lincoln. Nebraska Water Pollution Control Council.
For primary bibliographic entry see Field 05G.
W71-13694

LAW OF THE SEA: A SYNOPSIS: POLLUTION.

San Diego Law Review, Vol. 8, No. 3, p 665-682, 1971. 18 p, 39 ref.

Descriptors: *Federal government, *State governments, *Water pollution control, *Law of the sea, International law, International waters, California, Florida, Michigan, Legislation, Regulation, Legal aspects, Administrative agencies, Oil industry, Explorations, Oil wastes, Pollutants, Pollution abatement, Oceans, Judicial decisions, Ships, Water pollution sources, Water pollution effects.

Selected news reports concerning pollution are contained in this article. The article is divided into five categories. Domestic Pollution, the title of the first group, contains such topics as: (1) mercury and DDT found in fish, (2) oil spills in San Francisco and Long Island Sound, and (3) the consequences of dumping sewage sludge into oceans. The second category considers pollution control efforts of the federal government. Some of the reports in this section deal with: (1) oil-eating bacteria which self-destruct, (2) citizen-initiated environmental litigation, (3) tax exemptions for anti-pollution litigants, and (4) oil dumping by the Navy. The third group depicts recent pollution control efforts by states. A California coastline protection bill, anti-pollution legislation in Florida, and environmental legislation in Michigan are examples of this group. A fourth category lists recent environmental suits: (1) against oil companies for violating drilling regulations, (2) against the Navy for oil spills, and (3) against a shipping company for the Maritime Corporation settlement pumping of oily bilges. International pollution is the last category. Examples of this category include: (1) a Russian arrested for oil dumping in Alaska, (2) an English Channel collision and oil spill, (3) a NATO oil pollution ban, and (4) an International Chamber of Shipping safety guide for tankers. (Hart-Florida)
W71-13695

FROM WHENCE COMETH OUR HELP. CONSERVATIONIST'S SEARCH FOR A JUDICIAL FORUM FOR ENVIRONMENTAL RELIEF,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 05G.
W71-13696

THE AMERICAN LEGAL SYSTEM AND ENVIRONMENTAL POLLUTION,
Tulane Univ., New Orleans, La.
For primary bibliographic entry see Field 05G.
W71-13697

LEGAL TECHNIQUES FOR POLLUTION CONTROL: THE ROLE OF THE PUBLIC,
British Columbia Univ., Vancouver School of Law.
For primary bibliographic entry see Field 05G.
W71-13698

ANTI-POLLUTION LEGISLATION AND ITS ENFORCEMENT: AN EMPIRICAL STUDY,
For primary bibliographic entry see Field 05G.
W71-13699

ADMIRALTY REMEDIES FOR VESSEL OIL POLLUTION OF NAVIGABLE WATERS,
For primary bibliographic entry see Field 05G.
W71-13700

GUIDELINES FOR THE DEVELOPMENT OF WATER POLLUTION CONTROL AND ABATEMENT PLANS FOR SEWAGE DRAINAGE BASINS.
Washington State Dept. of Ecology, Olympia.
For primary bibliographic entry see Field 05G.
W71-13701

OIL AND OYSTERS DON'T MIX: PRIVATE REMEDIES FOR POLLUTION DAMAGE TO SHELLFISH,
For primary bibliographic entry see Field 05G.
W71-13702

ENVIRONMENTAL GUIDELINES FOR THE CIVIL WORKS PROGRAM OF THE CORPS OF ENGINEERS.
Corps of Engineers, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-13703

COMPREHENSIVE PLAN, NOTICE OF PUBLIC HEARING.
Delaware River Basin Commission, Trenton, N.J.

Federal Register, Vol 36, No 134, p 13051-13052 (July 1971). 2 p.

Descriptors: *Delaware River Basin Commission, *Administrative agencies, *Water quality control, *Environmental sanitation, Water pollution control, Federal government, Delaware River, Interstate commissions, River Basin Commissions, Interstate rivers, River basins, Regulation, Standards, Administration, Administrative decisions, Water policy, Water resources, Water resources development, Water pollution, Water quality, Water law, Legal aspects, Public rights, Adoption of practices.

Notice is herein given by the Delaware River Basin Commission that it will hold a hearing which will include the following three areas of policy: (1) a comprehensive plan amendment providing for environmental review, (2) water quality, and (3) amendments to rules of practice and procedure dealing with environmental statements. Stream quality objectives and effluent quality requirements have been proposed to be used in administering and enforcing the Commission's water quality standards. Environmental statements are proposed for specified types of projects. The content of the proposed statement and proposed procedural requirements for hearings and administrative action are set forth. (Robinson-Florida)
W71-13704

GRANTS FOR CONSTRUCTION OF TREATMENT WORKS, LIMITATIONS.
Environmental Protection Agency, Washington, D.C.

Federal Register, Vol 36, No 134, p 13029-13030 (July 1971). 2 p.

Descriptors: *Grants, *Water pollution control, *Federal government, *Financing, *Treatment facilities, Government finance, Waste water treatment, Regulation, Water policy, Water pollution, Water quality, Water quality control, Pollution abatement, Environmental sanitation, Capital supply, Projects, Waste treatment, Waste water disposal, Waste water (Pollution), Waste disposal, Sewage disposal, Sewage treatment, Industrial wastes, Liquid wastes.

Pursuant to the Federal Water Pollution Control Act, the Administrator of the Environmental Protection Agency herein promulgates the following regulations. No grant shall be made for any water pollution control project unless satisfactory assurance is given that sewage or industrial wastes will be adequately treated to abate, control, or prevent water pollution. This assurance must show the following: (1) substantially complete removal of settleable or floatable materials, (2) removal of 85% of 5-day biochemical oxygen demand, (3) substantially complete reduction of pathogenic microorganisms, and (4) any additional treatment necessary to meet applicable water quality standards. The second requirement may be waived for projects discharging wastes into open ocean waters through an ocean outfall. The second and third requirements may be waived for projects designated solely to treat or control wet weather combined sewer overflows if such project is consistent with river basin and regional or metropolitan plans to meet approved water quality standards. (Robinson-Florida)
W71-13705

WATER QUALITY STANDARDS.
Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-13706

NOTICE OF PUBLIC HEARINGS (AMENDMENT OF COMPREHENSIVE PLAN).
Delaware River Basin Commission, Trenton, N.J.

Federal Register, Vol 36, No 142, p 13705-13706 (July 1971). 2 p.

Descriptors: *Delaware River Basin Commission, *Delaware River, *Water resources development, *Treatment facilities, Administrative decisions, Administrative agencies, Federal government, Interstate commissions, River basin commissions, Interstate rivers, River basins, Regulations, Standards, Administration, Water policy, Water resources, Water law, Legal aspects, Projects, Project planning, Planning, Sewage disposal, Public rights.

Notice is hereby given by the Delaware River Basin Commission that it will hold hearings on proposals to amend the Comprehensive Plan to include ten projects. The projects are listed, and an explanation of each is provided. The enumerated projects relate to: (1) well water supply, (2) sewage treatment, and (3) sewage interceptors. (Robinson-Florida)
W71-13707

WATER MANAGEMENT BUREAU.
Michigan State Dept. of Natural Resources, Lansing.
For primary bibliographic entry see Field 05G.
W71-13708

ENVIRONMENTAL PROGRESS DURING 1970.
For primary bibliographic entry see Field 05G.
W71-13709

POLLUTION CONTROL--FINANCING.

Public Laws of Maine, 1971, ch 210, amending, Maine Rev. Stat. Ann. tit. 30, secs 5325 thru 5342.

Descriptors: *Maine, *Pollution abatement, *Financing, *Treatment facilities, Water pollution control, Air pollution, Government finance, Federal government, State governments, Loans, Costs, Construction, Operation and maintenance, Cities, Pollutants, Environmental sanitation, Administrative agencies, Contracts, Planning, Programs, Economics, Logal governments.

This amendment to the Municipal Industrial and Recreation Obligations Act, under which pollution-control facilities are to be financed by issuing revenue obligation securities, includes commercial, pollution-control, and combined projects in order to forestall delay in Maine's pollution-control program. A pollution-control project is any structure, equipment, or facility necessary to prevent, control, or reduce pollution of the air, water, or the earth, together with all lands, rights, and franchises acquired by the municipality for the construction and operation of the project. A combined project is any combination of industrial-commercial, pollution control, and recreational project undertaken by a single municipality for a common lessee or group of lessees. The amendment allows municipalities to acquire property, including underwater and riparian rights; to contract with federal and state governments; and to accept government financial assistance. Certification of approval of the project from the Environmental Improvement Commission is mandatory, and new guidelines for evaluating projects are provided. The amendment incorporates these new projects into those provisions dealing with balloting for securities, validation suits, and remedies to security holders. (Rees-Florida)
W71-13712

OLYMPIA OYSTER CO. V. RAYONIER, INC. (ACTION FOR DAMAGES FROM WATER POLLUTION DISMISSED FOR FAILURE TO SHOW VIOLATION OF PERMIT).
229 F. Supp. 855-861 (W. D. Wash. 1964).

Descriptors: *Washington, *Water pollution, *Permits, *Adjudication procedure, Legal aspects, Judicial decisions, Administrative agencies, Regulation, Pollutants, Industry, Commercial fishing, Industrial wastes, Chemical wastes, Shellfish, Oysters, Commercial fishing, Remedies, Water pollution sources, Water pollution effects, State governments, Jurisdiction.

Plaintiff oyster company sought to recover damages from defendant chemical company for water pollution injuring its oyster beds. The action was subject to the doctrine of primary administrative jurisdiction; plaintiff could therefore only prevail by proving that defendant had violated the terms of its permit from the Washington Pollution Control Commission. Some four years had elapsed since the prior decision requiring plaintiff to develop proof of violation of defendant's permit. Following presentation of plaintiff's evidence in the federal district court, defendant moved for a directed verdict. The court reviewed the evidence and determined that plaintiff had not presented substantial evidence tending to prove that defendant had failed to comply with the terms of its permit. Hence, defendant's motion for a directed verdict was granted, and the action was dismissed on the merits, with prejudice. (Hart-Florida)
W71-13722

POLLUTION MANAGEMENT IN THE COASTAL STATES,
Ocean Science Center of the Atlantic Commission, Savannah, Ga.
For primary bibliographic entry see Field 05G.
W71-13728

COMPREHENSIVE FRAMEWORK PLANNING IN THE COASTAL ZONE,
Center for the Environment and Man, Inc., Hartford Conn.
For primary bibliographic entry see Field 06B.
W71-13729

THE NECESSITY OF LOCAL SUPPORT IN COASTAL ZONE PLANNING,
Interstate Electronics Corp; Anaheim, Calif. Oceanics Div.
For primary bibliographic entry see Field 06B.
W71-13730

ENVIRONMENTAL LAW - CONGRESS HAS AUTHORITY UNDER THE COMMERCE CLAUSE TO PROTECT MARINE ECOLOGY IN INTRASTATE WATERS - CORPS OF ENGINEERS TO TAKE ENVIRONMENTAL CONSIDERATIONS INTO ACCOUNT IN THE MANAGEMENT OF NAVIGABLE WATERS.
Villanova Univ., Pa.
For primary bibliographic entry see Field 05G.
W71-13743

THE ENVIRONMENTAL LAW EXPLOSION - A SURVEY OF ANTI-POLLUTION LAWS AFFECTING THE OIL INDUSTRY,
Pace Coll., New York.
For primary bibliographic entry see Field 05G.
W71-13744

OWENS V. UNITED STATES (LIABILITY OF UNITED STATES FOR NEGLIGENT APPLICATION OF INSECTICIDE, POLLUTING POND OF ADJACENT LANDOWNER).

294 F. Supp. 400-405 (S.D.Ala. 1968).

Descriptors: *Alabama, *Water pollution, *Insecticides, *Rainfall, Cattle, Ponds, Streams, Federal

government, Administrative agencies, Rain, Legal aspects, Judicial decisions, Water pollution effects, Water pollution sources, Pollutants, Water wells, Damages, Remedies, Regulation.

Plaintiff cattle rancher sought to recover damages for injury to his herd from defendant United States under the Federal Tort Claims Act. Plaintiff's property included part of a small pond from which the cattle watered. The pond was supplied from rainfall and water drainage. A dry-bed drainage creek drained into the pond. Federal Department of Agriculture employees treated the property adjoining plaintiff's with a chemical insecticide. Thereafter, a heavy rainfall occurred which washed this insecticide into the dry-bed creek, and ultimately to plaintiff's pond. The pond was fenced off, and the cattle were not poisoned. Nevertheless, plaintiff claimed damages from loss of part of his pasture, reduced milk production, increased food cost, and the expense of drilling a well for water. Defendant contended that plaintiff's injury resulted from the rainfall, an act of God, and that it was not liable. The Federal District Court however, determined that under Alabama law an act of God would not render defendant immune where its negligence was also an acutal cause of plaintiff's injury. Since the court concluded that defendant's negligence was an actual cause of the injury, defendant was held liable. (Hart-Florida)
W71-13745

ELEMENTS OF OCEANS AND COASTAL ZONE MANAGEMENT,
California State Advisory Commission on Marine and Coastal Resources, Sacramento.
For primary bibliographic entry see Field 02L.
W71-13750

COASTAL WATER POLLUTION, POLLUTION OF THE SEA BY OIL SPILLS.
North Atlantic Treaty Organization, Brussels (Belgium).
For primary bibliographic entry see Field 05G.
W71-13751

FEDERAL REGULATIONS AND POLLUTION CONTROLS ON THE U.S. OFFSHORE OIL INDUSTRY,
Geological Survey, Washington, D.C. Conservation Div.
For primary bibliographic entry see Field 05G.
W71-13757

EXECUTIVE ACTION - NATIONAL PLANS,
Department of Trade and Industry, Marine Division, Great Britain.
For primary bibliographic entry see Field 05G.
W71-13773

NATIONAL CONTINGENCY PLANNING,
Department of Transportation, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-13774

PLAN OF STRUGGLE AGAINST THE ACCIDENTAL AND MASSIVE POLLUTIONS FROM HYDROCARBONS REJECTED INTO THE SEA, PLAN DE LUTTE CONTRE LES POLLUTIONS ACCIDENTELLES ET MASSIVES PAR HYDROCARBURES REJETES EN MER,
Ministere de l'Interieur, Brussels (Belgium). Service de la Protection Civile.
For primary bibliographic entry see Field 05G.
W71-13776

INTERNATIONAL COOPERATION,
Commission Interministerielle de la Politique Scientifique, Brussels (Belgium).
For primary bibliographic entry see Field 05G.
W71-13778

UNITED STATES V. ESSO STANDARD OIL CO. OF PUERTO RICE (CRIMINAL PROSECUTION OF OIL COMPANY FOR VIOLATION OF RIVERS AND HARBORS ACT).

375 F.2d 621-624 (3d Cir. 1967).

Descriptors: *Rivers and Harbors Act, *Water pollution, *Oil industry, *Navigable waters, Legal aspects, Judicial decisions, Water pollution control, Water pollution sources, Water pollution effects, Water quality, Water quality control, Legislation, Federal government, Remedies, Navigation.

Plaintiff United States sought a criminal conviction of defendant oil company for violation of section 13 of the Rivers and Harbors Act, which prohibits discharge of refuse into navigable waters. Defendant had dumped petroleum products onto the ground at its tank farm; the products flowed across a road and adjacent property, and ultimately into the sea. The Act creates two offenses: (1) discharge of refuse into navigable waters and (2) deposit of material on the banks of navigable waters, where it may be washed into navigable waters and impede navigation. Plaintiff and defendant agreed that navigation was unimpeded by the discharge. Defendant contended, therfore, that since it did not discharge the petroleum product into the waters, but onto the bank, section 13 was not violated. The Federal Court of Appeals, however, interpreted section 13 liberally, and held that defendant's conduct was sufficient for conviction. Defendant's challenge to the sufficiency of the evidence was also rejected. (Hart-Florida)
W71-13780

STATE V DUXBURY (CONSTITUTIONALITY OF LEGISLATION ESTABLISHING POLLUTION CONTROL AGENCY).
160 W2d 88 - 94 (Neb 1968).

Descriptors: *Nebraska, *Legislation, *Treatment facilities, *Government finance, Credit, Judicial decisions, Legal aspects, Water law, Planning, State governments, Local governments, Water resources development, Financing, Loans, Water pollution control, Water quality control, Waste water disposal, Waste disposal, Administrative agencies, Adoption of practices.
Identifiers: *Constitutionality.

Plaintiff Attorney General brought this original action against defendant members of the Nebraska Clean Waters Commission to determine the validity of the act establishing the Commission. Legislation provided that the Nebraska Clean Waters Commission was to assist municipalities in the planning and financing of waste water treatment works, waste water collecting systems, and solid waste disposal facilities. The Commission was authorized to issue bonds and notes and to loan money to municipalities to accomplish the purposes of the legislative act. The Commission was also authorized to pledge all or any part of the fees and charges received by the Commission as security for the payment of bonds and notes issued by it. Plaintiff alleged the Commission's authority violated constitutional provisions. The Supreme Court of Nebraska held that the Nebraska Clean Waters Commission's power to pledge fees and charges as security for indebtedness violated a Nebraska constitutional limitation on state indebtedness. The Court ruled, however, that the unconstitutional portions of the Nebraska Clean Waters Commission Act could be severed from it without destroying the entire plan of the Act. The Court upheld the validity of the remainder of the Act. (Johnson-Florida)
W71-13782

CITY OF SAN ANTONIO V. CDJ ENTERPRISES, INC (ISSUANCE OF EFFLUENT DISCHARGE PERMITS).

402 SW2d 573-576 (Ct. Civ. App. Tex. 1966).

Descriptors: *Texas, *Water quality control, *Permits, *Treatment facilities, Sewage treatment, Judicial decisions, Legal aspects, Water law, Regulation, Administrative agencies, Legislation, State governments, Local governments, Water pollution control, Standards, Water pollution effects, Water pollution sources, Municipal wastes, Effluents, Pollutants, Water pollution.

Defendant corporation was granted a permit by the Texas Water Pollution Control Board authorizing it to discharge treated municipal sewage effluent into a creek. The permit imposed certain conditions on the discharge; one condition was that the quantity of discharge was limited to 696,000 gallons per day. Plaintiff city and landowners brought suit to set aside the order of the Board granting the permit. Plaintiff city contended the design of the proposed treatment plant was inadequate. The trial court held that the order of the Board was valid and supported by substantial evidence which indicated that effluent discharged under the conditions of the permit would not cause any appreciable pollution to the creek. The Texas Court of Civil Appeals affirmed and held that evidence of the inadequacy of a treatment plant is not pertinent to the validity of a discharge permit. The court ruled that the Board had been established to control effluent passing into the waters of the state, and the legislature intended the Health Department, not the Water Pollution Control Board, to approve the design of treatment plants. (Johnson-Florida)
W71-13783

CITY OF MOORE V CENTRAL OKLAHOMA MASTER CONSERVANCY DISTRICT (INJUNCTION TO PROHIBIT CITY FROM POLLUTING RESERVOIR).
441 P.2d 452-461 (Okla 1968).

Descriptors: *Oklahoma, *Permits, *Sewage effluents, *Reservoirs, Dams, Rivers, Domestic water, Administrative agencies, Prescriptive rights, Water pollution, Water pollution sources, Water pollution effects, Water pollution control, Pollutants, Pollution abatement, Cities, Municipal wastes, Public health, Treatment facilities, Judicial decisions, Legal aspects, Local governments.

Plaintiff conservancy district sought to enjoin defendant municipality from discharging treated sewage effluent into plaintiff's reservoir. In 1959, plaintiff was formed to dam the Little River to create a water supply for several cities; the project was to be completed in 1964. In 1962, defendants obtained a new discharge permit from the state, which specifically prohibited defendant's effluent from being discharged into the Little River after the reservoir was formed. Defendant and its predecessor had been discharging effluent into the river under permit since 1935. Dispite the restriction in its permit, defendant planned to continue discharging into the river after the reservoir was completed; defendant contended its modern treatment would not pollute the reservoir. Plaintiff sought to enjoin this action. Defendant contended it had acquired a prescriptive right to discharge its effluent. The Oklahoma Supreme Court, however, held that defendant's purported occupancy lacked the adverseness essential to a claim of prescriptive right, because the discharges were always under permit. Furthermore, the court held that defendant's attempted violation of the terms of its permit, and of state law, justified the trial court's injunction prohibiting the discharge. (Hart-Florida)
W71-13799

FISHING REGULATIONS; LICENSING.
Indiana Stat. Ann. secs. 11-406, 11-410, 11-607 (Supp. 1970).

Descriptors: *Indiana, *Fish conservation, *Water pollution control, *Damages, Legislation, Water law, Legal aspects, Fish management, Regulation, Water pollution, Water pollution sources, Water pollution effects, Aquatic weed control, Aquatic weeds, Remedies, Fishkill, Wildlife conservation.

All offal or filth accruing from the catching, curing, or shipping of fish in or near Lake Michigan shall be disposed of in such a manner as not to pollute such waters. It shall be unlawful for any person to chemically treat any aquatic vegetation in any waters or boundary waters of the state without first procuring a permit. Any person whether or not approval has been issued who discharges wastes or chemicals into water sufficient to kill wild animals shall be responsible for such kill. The attorney general shall bring a civil action to recover damages, and the damages shall be used to restore the wild animal population if possible. (Robinson-Florida)
W71-13809

AUGUSTINE V HINNEN (LIABILITY OF OIL LESSEE FOR SALINE POLLUTION OF WATER SUPPLY ON ADJACENT LANDS).
443 P.2d 354-360 (Kan. 1968).

Descriptors: *Kansas, *Saline water intrusion, *Injection wells, *Damages, Oil wastes, Oil fields, Oil industry, Water pollution, Water pollution sources, Water pollution effects, Water supply, Saline water-freshwater interfaces, Brine disposal, Drilling fluids, Oil wells, Byproducts, Waste disposal, Waste water disposal, Well permits, Well regulations, Administrative agencies, Subsurface runoff, Water wells, Cattle, Farms, Leases.

Plaintiff cattle rancher sued defendant oil and gas lessee for actual and punitive damages for saline pollution of plaintiff's water supply. Defendant installed an injection well for disposal of salt water from its drilling operation on its leasehold adjacent to plaintiff's tract. Defendant obtained a permit for the well from a state commission, although the data submitted for the permit was inaccurate. A braden head was installed on the well to prevent salt water form pipe leaks from rising to the surface. The saline water intruded into plaintiff's water supply and injured his farming operations and his cattle. At trial, plaintiff was awarded $12,651 actual damages and $18,000 punitive damages. The Kansas Supreme Court upheld the award for actual damages, and determined that plaintiff's action was not barred by the statute of limitations. The court observed that punitive damages are allowable when a defendant's conduct showed a reckless indifference and disregard of the rights of others. Defendant's violation of law relating to escape of salt water was not found sufficient to subject him to punitive damages. No other actions were proven tending to show a reckless disregard of plaintiff's rights, and the court reversed the award of punitive damages. (Hart-Florida)
W71-13816

REGULATION OF WATERCRAFT--SEWAGE DISPOSAL.
Nevada Revised Statutes secs 488.315 thru 488.335 (1965).

Descriptors: *Nevada, *Sewage disposal, *Boats, *Boating regulations, Sewage, Sewage treatment, Public health, Legal aspects, Administrative agencies, State governments, State jurisdiction, Standards, Pollution abatement, Water pollution control, Water quality, Water quality control, Water pollution, Water pollution sources.

Boats are herein defined as any vessel or watercraft moved by oars, paddles, sails, or other power mechanism, inboard or outboard, or any other vessel or structure floating upon the water whether or not capable of self-locomotion, including houseboats, barges, and similar floating objects. A marine toilet is defined as any toilet on or within any boat. The term sewage encompasses all human body wastes. No marine toilet on any boat operated upon the waters of the state shall be so constructed and operated as to discharge any inadequately treated sewage into such waters directly or indirectly, nor shall any container of inadequately treated sewage be placed or discharged into or near any waters of the state. The regulation also requires that any marine toilet located on or within any boat shall have securely affixed to the interior discharge opening a suitable treatment device constructed and maintained in accordance with regulations of the Health Division of the Nevada Department of Health. All sewage passing into or through such toilets shall pass solely through such devices. (Horwitz-Florida)
W71-13846

PEOPLE V CITY OF LOS ANGELES (SEWAGE DISPOSAL INTO BAY RESULTING IN POLLUTION OF SHORELINES).
325 P2d 639-648 (Dist Ct App Cal 1958).

Descriptors: *California, *Pollution abatement, *Cities, *Municipal wastes, Water pollution control, Water pollution sources, Water quality control, Water pollution, Domestic wastes, Treatment facilities, Waste disposal, Water pollution treatment, Sewage treatment, Sewage disposal, Sewage effluents, Bays, Legal aspects, Judicial decisions, State governments, Administrative agencies, Local governments, Jurisdiction.

Plaintiff municipalities sought an injunction against defendant city for abatement of a public nuisance. Plaintiffs alleged that defendant polluted the waters of a bay through sewage discharge, thereby causing pollutant deposits on plaintiffs' shores. Defendant alleged that one plaintiff city could not sue to enforce a prior judgment restricting defendant from discharging sewage into the bay. Defendant further alleged that the state water pollution control board had exclusive authority to enjoin public nuisances, and that plaintiffs had no right to prescribe the means or facilities that the city should use in treating and disposing of its sewage. The Second District Court of Appeal reversed a lower court dismissal of the causes of action and held that water pollution legislation was not intended to place in the state water pollution control board the exclusive power to abate nuisances created by water pollution. Municipalities have the right to seek pollution abatement through actions for public nuisance. A court may proscribe the use of present facilities creating pollution. The court held, however, that a municipality could not seek to enforce a prior judgment, where it was not a party to that action. (Smiljanich-Florida)
W71-13857

CITIES SERVICE OIL CO V. MERRITT (DAMAGES FOR THE POLLUTION OF SUBTERRANEAN WATERS).
332 P2d 677-688 (Okla. 1958).

Descriptors: *Subsurface waters, *Water pollution effects, *Oklahoma, *Oil industry, Oil wells, Oil wastes, Saline water intrusion, Creeks, Potable water, Damages, Judicial decisions, Legal aspects, Water pollution, Water wells, Remedies, Adjudication procedure.

Plaintiff landowner sued defendant petroleum companies for actual and punitive damages resulting from the salt water pollution of subterranean waters underlying plaintiff's water wells. The wells became permanently unpotable. Defendants alleged error by the trial court in: (1) not requiring plaintiff to prove negligence, (2) awarding excessive actual damages, and (3) awarding punitive damages improperly. The Supreme Court of Oklahoma held that: (1) the basis of liability for injury to property by oil pollution and salt water intrusion is either negligence or nuisance, (2) liability for a nuisance does not require proof of negligence since negligence is not an essential element of a cause of action for nuisance, (3) oil companies which are joint tortfeasors are each accountable for the entire amount of damages. The court ruled that plaintiff was entitled to damages measured by the difference in land value prior to and just after the injury. Plaintiff was held entitled to reimbursement for emergency expenditures made to minimize damages. Punitive damages were held allowable because defendants had intentionally permitted salt water to escape into nearby creeks. The punitive damages awarded, however, were held to be excessive. (Rees-Florida)
W71-13883

CRAWFORD V YEATTS (SALT WATER POLLUTION OF FARMLANDS FROM OIL DRILLING OPERATIONS).
395 SW2d 413-419 (Civ App Tex 1965).

Descriptors: *Texas, *Saline water intrusion, *Damages, *Remedies, Water pollution, Legal aspects, Judicial decisions, State governments, State jurisdiction, Pollution abatement, Water pollution control, Water pollution sources, Saline water, Oil industry, Drilling, Water law, Relative rights, Water quality, Oil fields, Farms, Groundwater.

Plaintiff landowner sought to recover damages for injury to his farmlands caused by defendant oil lease operator. Defendant disposed of salt water, produced as a by-product of its oil drilling, by the use of a surface evaporation pit. The salt water entered the ground through the porous areas in the pit and polluted plaintiff's fresh groundwater supply. The trial court awarded plaintiff a judgment of $17,064 for permanent damages to the farm. On appeal plaintiff contended that defendant negligently disposed of the salt water and that such negligence was the proximate cause of the injury. Defendant contended that the action was barred by the statute of limitations, that there was insufficient evidence to establish negligence, and that the damages were excessive. The Texas Court of Civil Appeals affirmed the judgment, holding that the statute of limitations did not begin to run until plaintiff discovered or should have discovered the salt water damage to the land and that plaintiff produced ample evidence to support the finding of negligence and the amount of damages through the use of lay and expert witnesses. (Horwitz-Florida)
W71-13899

PATTERNS OF POLITICS IN WATER RESOURCE DEVELOPMENT: A CASE STUDY OF NEW MEXICO'S ROLE IN THE COLORADO RIVER BASIN BILL,
New Mexico Univ., Albuquerque. Div. of Government Research.
Helen M. Ingram.
Available from the National Technical Information Service as PB-203 490, $3.00 in paper copy, $0.95 in microfiche. Publication No. 79, December 1969. 96 p, 1 map. OWRR Project B-012-NMEX (1).

Descriptors: *Water resources development, Decision making, *New Mexico, *Legal aspects, *Colorado River Basin, *Political aspects, Interstate, Regions, *Water policy.
Identifiers: Political model, Policy making, Colorado River Basin Act, Hooker dam.

While economists and engineers have fairly concrete and explicit criteria for judging water projects as economically justifiable and technically feasible, political scientists have yet to provide comparable insight into the process by which water development becomes politically viable. This project develops a pattern of politics which illustrates the process through which water development proposals become politically feasible. The basic variable which structures the pattern is the perception of the risks and rewards involved in different policy choices in water. The relevance and accuracy of the political model which is constructed is tested against examples of policy making. A case study is made of the way New Mexico got its share of the Colorado River Basin Act of 1968. The authorizations of the Animas-La Plata project and Hooker Dam are examined in particular detail. The pattern of politics set out is found to trace with some accuracy the concrete cases of policy making. Where gaps occur in the model and there are lapses in its explanatory power, these are identified as areas for further research. (Wray-Chicago)
W71-13900

ITY OF TACOMA V WELCKER (EMINENT DOMAIN ACTION TO PREVENT POLLUTION OF MUNICIPAL WATER SUPPLY).

399 P2d 330-338 (Wash 1965).

Descriptors: *Washington, *Eminent domain, *Local governments, *Water pollution control, State governments, Judicial decisions, Legal aspects, Public health, Pollution abatement, Water quality control, Treatment facilities, Water pollution, Condemnation, Water law, Project planning, Riparian rights, Water rights, Water allocation, Water purification, Water management, Water policy, Water conservation.

Plaintiff city of Tacoma initiated this action in eminent domain seeking to acquire fee simple title to some 1,450 acres of land contiguous to the Green River. The purpose of the proposed acquisition was to protect the municipality's domestic and industrial water supply from pollution. The trial court refused to enter an order of public use and necessity and dismissed plaintiff's petition. Plaintiff claimed that such acquisitions are part of a plan which will ultimately give the city ownership and control over a buffer strip and surface filter blanket one half mile in depth on each side of the river, thus providing protection against pollution of the waters and minimizing the necessity of installing a filtration plant and thereby continuing to rely on the process of chlorination. The Supreme Court of Washington reversed the trial court's decision, stating that the furnishing of domestic water by a municipality constitutes a public use within the contemplation of the law of eminent domain, and that the city's proclamation of necessity for improvement of the water system was not arbitrary or capricious. (Horwitz-Florida)
W71-13905

ENGLE V. CITY OF OROVILLE (ABATED NUISANCE IS NO LONGER BASIS FOR INJUNCTION).
47 Cal. Rptr. 630-636 (Dist. Ct. App. 1965).

Descriptors: *California, *Pollution abatement, *Municipal wastes, *Damages, *Remedies, Sewage treatment, Water pollution control, Judicial decisions, Legal aspects, Water law, State governments, Local governments, Riparian rights, Waste treatment, Treatment facilities, Percolation, Water pollution, Effluents.
Identifiers: Injunction (Prohibitory).

Plaintiff downstream riparian landowners sought to enjoin defendant city from discharging sewage effluent and recover damages for alleged nuisance. Effluent from defendant's sewage plant caused water pollution until July 1960, when a new plant was constructed. Plaintiffs contended that the pollution should be enjoined as a nuisance. They also alleged that they had suffered damages from the loss of expected profits from a proposed motel on their land. Defendant contended that the damages were too speculative and that the need for the injunction no longer existed. The California Third District Court of Appeal held that an injunction should not be granted where conditions have so changed that no unlawful act is threatened at the time of the hearing. The court ruled that no injunction was necessary after defendant's new sewage plant began operating. The court also held that an award of damages for loss of profits required a satisfactory basis for estimating what probable earnings would have been. The court ruled plaintiffs' loss of prospective profits too speculative because no construction contract existed and no prospect ready and willing to build such a motel existed. (Johnson-Florida)
W71-13914

EFFECTIVE WATER QUALITY MANAGEMENT: IMPOSSIBLE DREAM OR ATTAINABLE GOAL,
Syracuse Univ., N.Y. Water Resources Center.
For primary bibliographic entry see Field 06B.
W71-13940

GARLAND GRAIN CO V D-C HOME OWNERS IMPROVEMENT ASS'N (INJUNCTION TO ABATE A NUISANCE FROM POSSIBLE POLLUTION).

393 SW2d 635-644 (Civ App Tex 1965).

Descriptors: *Texas, *Water pollution, *Riparian rights, *Waste disposal, Judicial decisions, Pollution abatement, Public health, Wastes, Water pollution treatment, Water quality, Water pollution sources, Legal aspects, Public rights, Water law, Competing uses, Water rights, Civil law, Natural use, Reasonable use, Relative rights, Remedies.

In a suit for a mandatory injunction to abate a nuisance, plaintiffs alleged that defendant's feed lots constituted a nuisance because of the obnoxious odor, noise, flies, and birds emanating from the lots which were such as to substantially interfere with the comfort and enjoyment of plaintiff's property and homes. The feed lots were also alleged to cause pollution of the Rowlett Creek due to drainage of animal wastes into the creek. A lower court issued an injunction prohibiting defendant from continuing to operate his business, but the Court of Civil Appeals reversed. The court was unable to find any evidence showing that any matter from defendant's pens ever reached the creek or that if it did, the substance from defendant's pens was the cause of the pollution. Plaintiffs were not entitled to an injunction on the grounds of a public nuisance for the state has the exclusive right to bring such actions. The court thus viewed this suit merely as an action to abate a private nuisance calling for a determination of the rights of riparian owners. (Horwitz-Florida)
W71-13946

STATE WATER RESOURCES BOARD,
Kansas Statutes Ann secs 74-2605 thru 74-2612 (Supp 1970).

Descriptors: *Kansas, *Water resources development, *Administration, *Water conservation, Legislation, Legal aspects, Interstate, Water resources, Pollution abatement, Research and development, Planning, Watershed management, Administrative agencies, Coordination, Resource development, Industrial use, Municipal water.

A Water Resources Board is created, as well as regulations concerning its membership and operating procedures. The Board is required to: (1) collect and compile information pertaining to climate, water and soil, as related to water usage for agricultural, industrial and municipal purposes and the availability of water supplies in state watersheds; (2) produce a statewide water development plan; (3) review water usage plans of state and local agencies; (4) study other state laws dealing with water resource development and conservation to determine whether they should be adopted; (5) make recommendations to the appropriate agency for intrastate and interstate coordination of water resources programs; and (6) make annual recommendations to the legislature. The Board may: (1) appoint citizens' advisory committees, (2) seek and accept grants and other financial assistance, (3) make necessary contracts, and (4) acquire necessary real or personal property or rights of way by purchase or eminent domain to implement specific watershed programs. (Gallagher-Florida)
W71-13948

PROBLEMS FOR INSTITUTIONAL ANALYSIS OF THE GREAT LAKES BASIN,
Indiana Univ., Bloominton. Dept. of Political Science; and Battelle Memorial Inst., Columbus, Ohio. Environmental Planning Group.
V. A. Ostrom, E. Ostrom, and I. L. Whitman.
In: Proceedings of the 13th Conference of Great Lakes Research, 1970, International Association of Great Lakes Research, p 156-167. 2 ref.

Descriptors: *Great Lakes Region, *Institutions, Economic evaluation.
Identifiers: *Government regulation, Water resources management, Common-pool resources, Flow-resources system.

A recent study by the Columbus and Pacific Northwest Laboratories of Battelle Memorial Institute shows that governmental institutions involved in water management, from localized special districts to international agencies, should be modified or restructured for effective resource management in the Great Lakes Region. The theoretical basis for long-range planning and management in the Great Lakes Basin involves knowledge of the horizontal and vertical interdependencies among agencies and focuses on several issues--river basin configuration, international configuration, engineering project orientation, informational needs, overemphasis on coordination, limitations on institutional authority, institutional innovation and political alignment. Sound management of common-pool resources requires (1) a mix of large- and small-scale public and private agencies, (2) accurate information for all parties provided by someone not involved in production activities related to the common-pool, and (3) some mechanism inducing individuals to take social costs of the actions into account in the decision-making process. (Dyer-Wisconsin)
W71-13949

DRAINAGE DISTRICTS-POLLUTION CONTROL.

Public Act 76-2441, Illinois Legislative Service, p 568-569 (1970) amending Illinois Annotated Statutes ch 42, sec 473.

Descriptors: *Illinois, *Drainage district, *Pollution abatement, *Waste treatment facilities, Legislation, Administrative agencies, Local governments, Water pollution control, Water pollution, Sewage, Financing, Administration.

An Illinois statute concerning drainage districts is amended to provide that whenever a drainage district collecting and conveying sewage through long, continued, and common usage of drainage facilities likely to cause water pollution, or when ordered to abate water pollution, the district may: (1) improve or construct sewage works, including treatment facilities, (2) levy and collect assessments against property benefited, (3) borrow money, and (4) issue revenue bonds and exercise other powers provided by law for their issue. (Hart-Florida)
W71-13950

COMMITTEE REPORT ON PUBLIC LAW 91-172.
CCH 1971 Standard Federal Tax Reporter Paragraph 1852.022, p 25,007-25,009. 3 p.

Descriptors: *Water pollution control, *Federal government, *Amortization, *Treatment facilities, Air pollution, Taxes, Tax rate, Legislation, Water law, Legal aspects, Water pollution, Water quality, Water quality control, Government finance, Nonstructural alternatives, Environmental sanitation.

Because of the importance of the pollution problem, legislation discussed by this report would provide a tax incentive through an amortization provision for pollution control facilities. Taxpayers, at their election, may amortize certified pollution control facilities over a period of 60 months. This only applies to certified pollution control facilities added to plants in operation before January 1, 1969. The amortization provision only applies to that portion of the cost attributable to the first 15 years of normal useful life. If a taxpayer elects the amortization deduction he may still get the additional first year depreciation allowance provided for in section 179. A definition of certified pollution control facilities is provided. To the extent of previous amortization deductions, a gain arising on the disposition of deduction may be discontinued at any time, but it is not available again for that facility. Amortization deductions apply only to facilities

placed in service before January 1, 1975. (Robinson-Florida)
W71-13952

SANITARIANS AND WATER AND WASTEWATER TREATMENT FACILITY OPERATORS.
North Carolina General Stat. secs. 90A-20 thru 90A-44 (Supp. 1969).

Descriptors: *North Carolina, *Treatment facilities, *Operation and maintenance, *Engineering personnel, Water treatment, Waste water treatment, Legislation, Legal aspects, Regulation, Administration, Administrative agencies, State governments, Water pollution control, Water quality, Water quality control, Water pollution treatment, Treatment, Permits, Training, Education, Occupations.

A Water Treatment Facility Operators Board of Certification and a Wastewater Treatment Plant Operators Board of Certification are hereby created, and their membership, powers, responsibilities, terms of office, and compensation are specified. Water treatment and wastewater treatment facilities are to be classified to determine the skill needed by operators, and operators of both types of facilities must receive grades of certificates corresponding to the classification of their facility. Minimum requirements of education, experience, and knowledge for each grade of certification shall be established. Provisions for the issuance and revocation of certificates are set forth. Provisions for the training of operators are detailed. Application fees sufficient to meet the anticipated costs of administering the classification and certification programs shall be imposed. Certified operators are required for such facilities on July 1, 1971. (Robinson-Florida)
W71-13954

TRI-STATE COMPACT AND INTERSTATE SANITATION COMMISSION.
New York Public Health Law, secs. 1299 thru 1299-1 (McKinney 1971).

Descriptors: *Interstate compacts, *Pollution abatement, *Regulation, Environmental sanitation, New York, New Jersey, Connecticut, Control, Interstate commissions, Water pollution control, Water quality control, Standards, Air pollution, Legal aspects, Legislation, Administrative agencies, Sewage treatment, Public health.

In order to more efficiently control future pollution and abate existing pollution, the states of New York, New Jersey, and Connecticut enter into a compact creating an Interstate Sanitation District, to be governed by a commission in accordance with powers enumerated in the compact. The compact contains provisions regulating: (1) the establishment of water quality standards, (2) required levels of sewage treatment, (3) the commission's power to set dates for compliance by municipalities with sewage treatment standards, (4) coordination of state and district authorities, and (5) allocation of costs. Provisions of New York's enabling legislation deal with: (1) the appointment and terms of commissioners, (2) interagency cooperation, (3) enforcement proceedings, (4) the prohibition of further pollution without an order from the commission, (5) public hearings for polluters, (6) preparation of plans to secure conformity with standards set pursuant to the compact, (7) reports and recommendations, (8) budgets, (9) financial examination of the commission's acounts, (10) evaluation of the commission's progress, and (11) the control of interstate air pollution between New York and New Jersey. (Gallagher-Florida)
W71-13996

6F. Nonstructural Alternatives

AMORTIZATION OF POLLUTION CONTROL FACILITIES.
Internal Revenue Service, Washington, D.C.
For primary bibliographic entry see Field 06E.
W71-13353

PAYING FOR POLLUTION BY THE POUND.
For primary bibliographic entry see Field 06E.
W71-13415

FLOOD PLAIN INFORMATION, TINKER AND CARVIN CREEKS, ROANOKE, VIRGINIA.
Corps of Engineers, Wilmington, N.C.
For primary bibliographic entry see Field 04A.
W71-13510

FLOOD PLAIN INFORMATION, LITTLE KANAWHA RIVER, GRANTSVILLE, WEST VIRGINIA.
Corps of Engineers, Huntington, W Va.
For primary bibliographic entry see Field 04A.
W71-13830

PROBLEMS IN DEVELOPING A NATIONAL FLOOD-PROTECTION POLICY,
For primary bibliographic entry see Field 06B.
W71-13889

6G. Ecologic Impact of Water Development

CHANGING POLITICAL ATTITUDES TOWARD BIORESOURCE CONSERVATION AND DEVELOPMENT,
Friends of the Earth, Washington, D.C. 917 15 St. N.W. 638-2525.
For primary bibliographic entry see Field 05C.
W71-13250

PATTERNS OF DISTRIBUTION OF COASTAL BIOTA, REMOTE SENSING, AND CONSERVATION OF RESOURCES,
Virginia Univ., Charlottesville. Dept. of Environmental Science.
For primary bibliographic entry see Field 05C.
W71-13254

HEALTH PHYSICS ASPECTS OF NUCLEAR FACILITY SITING SUMMARY OF CONFERENCE NO. 701106,
Health Physics Society.
For primary bibliographic entry see Field 05C.
W71-13390

ENVIRONMENTAL IMPACT OF HIGHWAY DEICING,
Environmental Protection Agency, Edison, N.J. Water Quality Lab.
For primary bibliographic entry see Field 05B.
W71-13434

STATEMENT OF ENVIRONMENTAL IMPACT-BRANTLEY PROJECT, NEW MEXICO.
Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 08A.
W71-13477

STATEMENT OF ENVIRONMENTAL IMPACT-YELLOW CREEK PORT PROJECT.
Tennessee Valley Authority, Chattanoga. Office of Health and Environmental Science.
For primary bibliographic entry see Field 08A.
W71-13478

STATEMENT OF ENVIRONMENTAL IMPACT-OVERLAND DITCH AND RESERVOIR COMPANY, HOTCHKISS, COLORADO, RECLAMATION PROJECT.
Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 08A.
W71-13479

ENVIRONMENTAL CONSERVATION: THE OIL AND GAS INDUSTRIES, VOLUME ONE.
National Petroleum Council, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-13661

THE EMERGENT RIGHT TO A DECENT ENVIRONMENT,
National Science Foundation, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-13662

PUBLIC LAND POLICY AND THE ENVIRONMENT, VOLUME 1, PART 1: THE LEGAL AND ADMINISTRATIVE FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT OF THE PUBLIC LANDS,
Public Land Law Review Commission, Washington, D.C.
For primary bibliographic entry see Field 06E.
W71-13665

ENVIRONMENTAL GUIDELINES FOR THE CIVIL WORKS PROGRAM OF THE CORPS OF ENGINEERS.
Corps of Engineers, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-13703

THE ENGINEER AND SOCIETY,
A. Wolman.
In: Water, Health and Society, Indiana University Press. 1969, p 364-370. 6 ref.

Descriptors: *Descriptors, *Management, *Administration, Specialization, *Social aspects.

The state of modern society is frequently considered the result of the evils of science. This reaction against science and the engineer is, in part, the responsibility of the scientist and the engineer who have deliberately limited their fields. A future task for the engineer is to transform the creations of science into the opportunities of society. The engineering mind must be expanded to perceive all complexities and dimensions of the problems. The engineer must be aware of the fact that his area of specialization is affected and affects such collateral fields as human relations, economics, and finance. Two examples are used to illustrate the general conclusions. (1) Some of the problems in the Ohio Basin include pollution of water, high flood risk, water storage, river traffic. The author maintains that the solution to the engineering difficulties is much easier than the solutions to the collateral issues. (2) In the Great Plains, dust and drought are still major problems. Solutions to these problems are technical, but they also involve the lawyer, administrator, financier, and teacher. (Stranchan-Chicago)
W71-13891

MOVEMENT AND PASTORAL NOMADISM: A TENTATIVE MODEL,
Air Force Academy, Colorado Springs, Colo. Dept. of Geography.
William A. Mitchell.
Rocky Mountain Social Science Journal, Vol. 8, No. 1, p 63-71, April 1971. 2 fig, 8 ref.

Descriptors: *Arid lands, *Grazing, *Human populations, *Migration, *Vegetation effects, Social aspects, Rainfall, Habitats, Variability, Seasonal, Water resources, Environmental effects, Grasslands, Landforms, Soil types, Economic feasibility, Political aspects, Temperature, Sheep, Cattle,

Goats, Crops, Winds, Semiarid climates, Model studies, Halophytes.
Identifiers: *Pastoral nomadism, *North Africa, *Human ecology, *Migratory drift, *Camels.

Pastoral nomadism is a non-industrial, non-mechanized way of life in arid and semiarid regions for groups of people who rely heavily on grazing animals for subsistence. The movements of 6 North African nomadic tribes are described. Each tribe undergoes movements in accord with the special environmental, social and economic constraints to which it is subject. Some tribes move vertically, others horizontally, following water and vegetation availability. Some tribes supplement animal products with seasonal crop products. Although most tribes move regularly within territorial and tribal boundaries, others undergo migratory drift which may occasionally lead to social conflict. Complex interacting environmental and cultural variables seem to underlie all tribal movements. These are: human, political and social variables; grazing animal needs; economic activities; and the habitat variables of climate, soils, water, landforms and vegetation. These variables are incorporated into a model in which the critical factors are weather and cultural activities. This is another example of the effect of social factors on resource utilization. (Casey-Arizona)
W71-13904

CAN ECOLOGY PROVIDE THE BASIS FOR SYNTHESIS AMONG THE SOCIAL SCIENCES,
For primary bibliographic entry see Field 06B.
W71-13963

07. RESOURCES DATA

7A. Network Design

A STUDY OF A WATER POLLUTION CONTROL SYSTEM TO MAINTAIN THE DISSOLVED OXYGEN STANDARD,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13279

A PILOT STUDY OF WEATHER, SNOW, AND AVALANCHE REPORTING FOR WESTERN UNITED STATES,
Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.
For primary bibliographic entry see Field 02C.
W71-13294

OPTIMIZATION IN DESIGN OF HYDRAULIC NETWORK, (A Discussion),
Johns Hopkins Univ., Baltimore, Md. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 06A.
W71-13979

7B. Data Acquisition

A NEW BACTERIOLOGICAL SAMPLING BOTTLE (AQUATIC STUDIES),
Eidgenoessische Anstalt Wasserversorgung Abbwasserreinigung and Gewaesserschutz, Zurich (Switzerland).
Ernst Schegg.
Limnol Oceanogr. 15 (5): 820-822, Illus, 1970.
Identifiers: Aquatic, Bacteriological, Bottle, Microorganisms, New, Sampling.

A bottle is described that facilitates sampling of anoxic microorganisms and immediate transfer of the sample for subsequent processing.--Copyright 1971, Biological Abstracts, Inc.
W71-13119

EFFICIENCY OF THE REVERSE-FLOW FILTER TECHNIQUE FOR CONCENTRATION OF PARTICULATE MATTER,
California Univ., San Diego. Inst. of Marine Resources.
O. Holm-Hansen, T. T. Packard, and L. R. Pomeroy.
Limnol Oceanogr. 15 (5): 832-835, Illus, 1970.
Identifiers: Cellular, Concentration, Filter, Flow, Matter, Particulate, Reverse, Technique.

The efficiency of the technique for concentrating particulate material from natural water samples by a hydrostatically driven upward flow of water through a membrane filter has been examined by quantitative determination of various chemical constituents before and after concentration. There was no evidence of killing or inactivation of live cells during concentration. This method of concentrating particulate matter for studies on cellular activities seems to be satisfactory if corrections are made for losses of cells adhering to the filter.--Copyright 1971, Biological Abstracts, Inc.
W71-13120

TURBIDITY INSTRUMENTATION: A FIBER-OPTIC SYSTEM FOR MEASURING SEDIMENT CONCENTRATION BY OPTICAL FOURIER TRANSFORMATION,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
For primary bibliographic entry see Field 05A.
W71-13167

SURVEY OF Sr87/Sr86 RATIOS IN STREAM AND GROUND WATERS OF OHIO,
Ohio State Univ., Columbus. Water Resources Center.
For primary bibliographic entry see Field 02F.
W71-13169

SHORELANDS PROTECTION AND MANAGEMENT ACT OF 1970.
For primary bibliographic entry see Field 06E.
W71-13221

PATTERNS OF DISTRIBUTION OF COASTAL BIOTA, REMOTE SENSING, AND CONSERVATION OF RESOURCES,
Virginia Univ., Charlottesville. Dept. of Environmental Science.
For primary bibliographic entry see Field 05C.
W71-13254

OPTICAL REMOTE SENSING OF BIORESOURCES,
Grumman Aerospace Corp., Bethpage, N.Y.
For primary bibliographic entry see Field 05C.
W71-13266

ABUNDANCE OF MARINE PHYTOPLANKTON IN SURFACE FILMS: A METHOD OF SAMPLING,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 05C.
W71-13270

DESIGN OF A SYSTEM FOR REMOTE POLLUTION RELATED MEASUREMENTS ON AN ESTUARY,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13276

A SYSTEM FOR REMOTE TELEMETRY OF WATER QUALITY DATA,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13281

MIXING IN SELF-SUSTAINED TURBULENCE,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13283

USE OF FLUORESCEIN TO MEASURE THE COMPOSITION OF WATERDROP SPLASH,
Agricultural Research Service, Morris, Minn.
D. R. Timmons, C. K. Mutchler, and E. M. Sherstad.
Water Resources Research, Vol 7, No 4, p 1020-1023, August 1971. 3 tab, 13 ref.

Descriptors: *Tracers, *Dye releases, *Impact (Rainfall), *Erosion, e Energy, Soil erosion, Laboratory tests, Rainfall simulators, Simulated rainfall.
Identifiers: *Splashing, Raindrop splash.

Fluorescein was used as a tracer to measure the amount of waterdrop water in splash after impact of the waterdrop in various depths of water. The addition to water of up to 50 ppm of fluorescein caused negligible changes in liquie density, surface tension, and viscosity. The tracer technique was successfully used to show the proportions of waterdrop water in splash from varying depths of target water. The impact of various sizes of waterdrops containing about 0.65-4.50 micrograms of fluorescein on targets with different water depths resulted in fluorescein concentrations of 5-97 ppb. Most of the fluorescence measurements required 100 ppb of fluorescein as the high standard, and the standard deviation of the difference in fluorescence for triplicate samples (with the same drop size and target water depth) was 1.7 ppb for 59 groups of triplicate samples. (Knapp-USGS)
W71-13288

PHOTOMETRIC DETERMINATION OF SMALL AMOUNTS OF OXYGEN IN WATER WITH 3,3'-DIMETHYLNAPHTHIDINE,
Central Sewage Treatment Plant, Brno, (Czechoslovakia).
For primary bibliographic entry see Field 05A.
W71-13292

RECENT ADVANCES IN APPLICATIONS OF ISOTOPES AND RADIATION IN THE UNITED STATES,
Atomic Energy Commission, Washington, D.C. Div of Isotopes Development.
For primary bibliographic entry see Field 05B.
W71-13377

IN SITU MEASUREMENTS OF ENVIRONMENTAL RADIOACTIVITY,
Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 05C.
W71-13395

REMOTE SENSING BIBLIOGRAPHY FOR EARTH RESOURCES, 1969,
Geological Survey, Washington, D.C.
J. P. Glasby, and D. G. Lowe.
Available from NTIS, Springfield, Va as PB-202 726, $3.00 in paper copy; $0.95 in microfiche. Geological Survey Report, May 1971. 182 p, 612 ref, 3 index.

Descriptors: *Remote sensing, *Bibliographies, *Information retrieval, Publications, Satellite (Artificial), Application methods, Instrumentation, Data collections, Terrain analysis, Water resources, Meteorological data, Urbanization, Mapping, Aerial photography, Glaciation, Oceanography, Geologic investigations, Geophysics, Pollutant identification.
Identifiers: *Earth satellite techniques, *Earth resources, Marine resources, Aircraft surveys.

A compilation of 612 reference citations from 1969 literature is given in this the fourth in a series of bibliographies on remote sensing. Technical

material concerning methodology and applications for earth resources studies is cited, stressing advancements in airborne and earth satellite techniques. The citations cover nine subject categories and are arranged alphabetically by title under each category and in consecutive numerical order. Each item includes title, bibliographic citation, and a set of indexing descriptors. Documents are cited for the following fields: agriculture, atmospheric sciences, cartography, ecology, fisheries, forestry, geodesy, geography, geology, geomorphology, geophysics, glaciology, hydrology, instrumentation, land use, limnology, marine resources, techniques, urbanization, and water resources. Indexes with applicable citation numbers are provided for author, corporate author, and subject terms. The cumulative subject term index at the end of the volume provides necessary access to the key-word descriptors. The 70 journals searched for reference items are listed. (Lang-USGS)
W71-13442

ESTIMATION OF DESIGN FREEZING INDICES,
Hardy (R. M.) and Associates Ltd., Edmonton (Alberta).
For primary bibliographic entry see Field 02C.
W71-13445

A DEVICE FOR MEASURING DOWN-HOLE PRESSURES AND FOR SAMPLING FLUIDS IN GEOTHERMAL WELLS,
Geological Survey, Menlo Park, Calif.
R. O. Fournier, and A. H. Truesdell.
Geological Survey Research 1971, Chapter C, Professional Paper 750-C, p C146-C150, 1971. 5 fig.

Descriptors: *Pressure measuring instruments, *Sampling, Hydrostatic pressure, Instrumentation, Geothermal studies, Thermal water, Steam, Piezometers.
Identifiers: *Geothermal wells.

A down-hole pressure gage and sampler uses long flexible stainless-steel tubes to measure pressures in geothermal wells by balancing gas pressure in the tube against the hydrostatic pressure external to the tube. In wells with positive wellhead pressure, water samples may be collected from any desired depth by allowing water to flow up through the steel tube (provided boiling does not occur during ascent). (Knapp-USGS)
W71-13457

A DEVICE FOR COLLECTING DOWN-HOLE WATER AND GAS SAMPLES IN GEOTHERMAL WELLS,
Geological Survey, Menlo Park, Calif.
R. O. Fournier, and J. C. Morganstern.
GPO, Washington, DC 20402 - Price $2.75. Geological Survey Research 1971, Chapter C, Professional Paper 750-C, p C151-C155, 1971. 1 fig, 2 ref.

Descriptors: *Sampling, *Water wells, *Thermal water, *Geothermal studies, Instrumentation, Steam, Pressure, Water temperature.
Identifiers: Yellowstone National Park (Wyo).

A sampling device with an internal volume of about 500 ml was designed to collect liquid and gas samples in wells where both steam and water are present at temperatures up to about 280 deg C. A long flexible stainless steel tube serves as the support cable. The sample device is lowered in the open position and fluid flows through it during its descent. Closure is accomplished by nitrogen gas pressure applied from the surface through the flexible tube to a piston and plunger within the sample chamber. Continued application of nitrogen gas pressure during withdrawal of the device prevents leakage caused by changing conditions of temperature and pressure. The sampling device has been used successfully to collect water and gas samples from research holes drilled in hot-springs areas of Yellowstone National Park, Wyo. (Knapp-USGS)
W71-13458

DATA RELAY SYSTEM SPECIFICATIONS FOR EARTH RESOURCES TECHNOLOGY SATELLITE IMAGE INTERPRETATION,
Geological Survey, St. Louis, Mo.
James F. Daniel.
GPO, Washington, DC 20402 - Price $2.75. Geological Survey Research 1971, Chapter C, Professional Paper 750-C, p C192-C195, 1971. 1 tab, 3 ref.

Descriptors: *Remote sensing, *Telemetry, *Satellites (Artificial), Stream gages, Gaging stations, Water levels, Water quality, Data transmission, Data collections, Hydrologic data, Instrumentation.
Identifiers: Earth Resources Technology Satellite.

The first Earth Resources Technology Satellite for the Earth Resources Observation Systems program is scheduled for launch in early 1972. Included among the experiments to be conducted with this satellite is the relay of ground-sensor data (primarily stream-gage height and quality parameters) in a near real-time mode. The goals of the experiment are to (1) provide ground truth to aid in interpretation of the imagery obtained from onboard sensors and (2) establish the feasibility of real-time data relay to the satellite for aid in river basin management. (Knapp-USGS)
W71-13460

THE ROLE OF REMOTELY SENSED AND RELAYED DATA IN THE DELAWARE RIVER BASIN,
Geological Survey, Harrisburg, Pa.
R. W. Paulson.
Geological Survey Research 1971, Chapter C, Professional Paper 750-C, p C196-C201, 1971. 4 fig, 3 ref.

Descriptors: *Remote sensing, *Telemetry, *Satellites (Artificial), *Delaware River Basin Commission, Stream gages, Gaging stations, Water levels, Water quality, Data transmission, Data collections, Hydrologic data, Instrumentation.
Identifiers: Earth Resources Technology Satellite.

The U.S. Geological Survey operates a system of hydrologic stations in the Delaware River basin that provides data to water-resources agencies in the basin. Data from 20 stations will be radiotelemetered from the basin to the Earth Resources Technology Satellite-A (which will be launched in 1972) and relayed to a ground acquisition site. The data will be sent by landline teletype from the acquisition site to the Geological Survey's Current Records Center in Philadelphia for dissemination to water-resources agencies. The existing time lag of 2 weeks to 2 months between the data collection and dissemination can be reduced to 12 hours. (Knapp-USGS)
W71-13461

A METHOD FOR ESTIMATING EFFECTIVE POROSITY IN A RUBBLE CHIMNEY FORMED BY AN UNDERGROUND NUCLEAR EXPLOSION,
Geological Survey, Denver, Colo.
M. S. Garber.
GPO. Washington, D.C. 20402-Price $2.75. Geological Survey Research 1971, Chapter C, Professional Paper 750-C, p C207-C209, 1971. 3 fig, 1 tab, 3 ref.

Descriptors: *Porosity, *Craters, *Nuclear explosions, *Withdrawal, *Drawdown, Nevada, Water table, Water levels, Water level fluctuations, Pumping, Hydrogeology.
Identifiers: *Rubble chimneys (Explosions), *Aquifer tests.

Explosion of a nuclear device underground at the Nevada Test Site produced a rubble chimney which was completely dewatered at the time of its formation and required a period of about 5 years to fill to the preexplosion water level. In numerous pumping tests conducted during the period of infill of the chimney, pumping often caused an interruption in the rise of water level in the chimney. The effective porosity of the chimney in selected zones was calculated by comparing the volume of water removed during a pumping test with the observed interruption in water-level rise resulting from infill. The porosity of the rubble chimney as determined by this method is between 1.5 and 7.9 percent. (Knapp-USGS)
W71-13463

THE SEA SLED - A DEVICE FOR MEASURING BOTTOM PROFILES IN THE SURF ZONE,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02J.
W71-13606

PREDICTION OF FORMATION COMPACTION FROM LABORATORY COMPRESSIBILITY DATA,
Koninklijke-Shell Exploratie en Produktie Laboratorium, Rijswijk (Netherlands).
For primary bibliographic entry see Field 02J.
W71-13615

THE DETERMINATION OF SURFACE CURRENTS IN THE OCEAN,
Moscow State Univ. (USSR). Dept. of Geophysics; and Moscow State Univ. (USSR). Dept. of Oceanology.
For primary bibliographic entry see Field 02E.
W71-13621

ALBEDO MEASUREMENTS OF AN ARCTIC ICE COVER FROM HIGH TOWERS,
McGill Univ., Montreal (Quebec). Dept. of Physics.
For primary bibliographic entry see Field 02C.
W71-13639

DETERMINATION OF TEMPERATURE ON ICE CAPS BY SEISMIC METHODS,
Muenster Univ. (West Germany). Institut fuer Reine and Angewandte Geophysics.
For primary bibliographic entry see Field 02C.
W71-13643

EROS AS A TOOL IN COASTAL ZONE MANAGEMENT,
Department of Natural Resources, Washington, D.C. Surveys and Marine Management Div.
D. W. Jamison.
In: Marine Technology Society 7th Annual Conference, August 16-18, 1971, Washington, D.C., p. 365-371. 1 ref.

Descriptors: *Remote sensing, *Resource allocation, *Aerial photography, *Data collections, *Systems analysis, Long-term planning, Resource development, Pollution abatement, Flood plain zoning, Water resource development.
Identifiers: *Earth Resources Observation System (EROS), NASA, Space camera platforms.

Management of the coastal zone involves the use of environmental planning to utilize the environmental data base in working with human goals for producing a series of resource allocation alternatives. After the alternative choice, the action program must be monitored to assess effects. A major tool in both planning and monitoring is the use of aerial photography. Based on results obtained in a demonstration project in Washington State during 1969-70, the Earth Resources Observation System (EROS) program -- in which NASA satellites are harnessed as space camera platforms -- appears to be of significance in local environmental planning. (Currer-PAI)

W71-13727

EVALUATION OF WASTE DISPERSION IN ESTUARIES USING FLUORESCENT TRACER DYE,
Raytheon Environmental Research Lab., New London, Conn.
For primary bibliographic entry see Field 05B.
W71-13738

OIL SPILL RECONNAISSANCE USING REMOTE-SENSING TECHNIQUES,
Texas Instruments, Inc., Dallas, Tex.
For primary bibliographic entry see Field 05B.
W71-13739

EVALUATION OF ESTUARINE CIRCULATION BY AERIAL PHOTOGRAPHY OF CURRENT DROGUES,
Raytheon Environmental Research Lab., New London, Conn.
For primary bibliographic entry see Field 05B.
W71-13740

AUTOMATED PRIMARY PRODUCTIVITY INSTRUMENT,
Biospherics, Inc; Rockville, Md.
G. W. Levin and W. A. Lindgren.
In: Marine Technology Society 7th Annual Conference, August 16-18, 1971, Washington, D.C., p 671-680. 11 fig, 1 tab.

Descriptors: *Primary productivity, *Instrumentation, *Measurement, Eutrophication, Photosynthesis, Phytoplankton, Water pollution effects, Automatic control, Monitoring, Bioassay.
Identifiers: *Radiocarbon primary productivity test, *Automated Primary Productivity Test (APPT).

Primary productivity is generally accepted by oceanographers as a fundamental measurement of biological activity in surface water. It measures the rate at which inorganic carbon is transformed into living matter by photosynthesis. Primary productivity measurements in surface waters can establish a baseline both to determine trends in eutrophication and to assess the effects of pollutants on phytoplankton. The Automated Primary Productivity Instrument (APPI) is designed to provide long-term, automated monitoring of primary productivity, simplify procedures, and conduct measurements in situ. (Currer-PAI)
W71-13741

DETECTION BY SATELLITE,
North Atlantic Treaty Organization, Brussels (Belgium). Div. of Scientific Affairs.
For primary bibliographic entry see Field 05G.
W71-13759

INSTRUMENTED PROBES FOR DEEP GLACIAL INVESTIGATIONS,
Cold Regions Research and Engineering Lab., Hanover, N.H.
For primary bibliographic entry see Field 02C.
W71-13841

ATMOSPHERIC EFFECTS ON INFRARED MULTISPECTRAL SENSING OF SEA-SURFACE TEMPERATURE FROM SPACE,
Michigan Univ., Ann Arbor. Willow Run Labs.
D. Anding, R. Kauth, and R. Turner.
National Aeronautics and Space Administration Report NASA CR-1858, July 1971. 97 p, 29 fig, 10 tab, 13 ref. NAS 12-2117.

Descriptors: *Remote sensing, *Water temperature, *Oceans, *Infrared radiation, Clouds, Hydrologic data, Data collections, Instrumentation, Analytical techniques.
Identifiers: *NASA, Space, Radiometric data.

The effect of the atmosphere on the infrared spectral radiance emanating from the sea surface is defined. The application of multichannel infrared remote sensing is discussed as a means of compensating for these atmospheric effects to obtain estimates of the sea temperature from high-altitude or space platforms. By performing simultaneous radiometric measurements in three narrow spectral intervals centered at 4.9, 9.1, and 11.0 micrometers, the effects of noncloudy atmospheres on the radiance was nearly completely compensated for and estimates of sea temperature to an accuracy of 0.15 deg K were obtained. For fields of view which contain clouds, the three-channel radiometric data indicate the presence of semitransparent or opaque clouds within the field of view. (Woodard-USGS)
W71-13851

DENSITY LOGS FROM UNDERGROUND GRAVITY SURVEYS IN HAWAII,
Hawaii Univ., Honolulu.
For primary bibliographic entry see Field 02F.
W71-13906

SOME TECHNIQUES IN EXPERIMENTAL SEDIMENTOLOGY,
Reading Univ. (England). Sedimentology Research Lab.
For primary bibliographic entry see Field 02J.
W71-13923

7C. Evaluation, Processing and Publication

APPLICATIONS OF CLIMATOLOGY AND METEOROLOGY TO HYDROLOGIC SIMULATION,
Texas A and M University, College Station.
For primary bibliographic entry see Field 02B.
W71-13150

NUMERICAL TAXONOMY: THE SYSTEMATIC CATEGORIZATION OF THE NORTH AMERICAN GENERA OF FRESH-WATER ALGAE,
Geological Survey, Washington, D.C.
P. E. Greeson, and G. E. Williams.
In: Symposium on Hydrobiology, 'Bioresources of shallow water environments', June 24-27, 1970, Miami Beach, Florida, p 150-161. 6 tab, 8 ref.

Descriptors: *Systematics, *Numerical analysis, *Aquatic algae, Algae, Microscopy, Analytical techniques, Data processing.
Identifiers: North American genera.

Taxonomy is the science concerned with the orderly arrangement of organism in some scheme of likenesses and differences among the various individuals. A system of numerical taxonomy has been developed for the identification of algal genera, which can be used by anyone with a basic understanding of microscopy. The basis of the system is to enumerate the apparent characteristics of an unidentified alga for the purpose of identification by the non-taxonomist. The format of information for characterizing the North American genera of fresh-water algae is shown in tables. Columns show the generic name, taxonomic classification of each genus, generic synonym designation, and characteristics of the genera. Detailed characteristics of each classification are listed under column numbers. Generic characteristic codes have been established by comparing each of the 429 genera of algae with all possibilities of variation for each of the characteristic-types, and are listed in a comprehensive reference file. A characteristic code for an unidentified alga can be developed by comparison with the checklist. Comparing a developed characteristic code with the comprehensive reference file can be done with an automatic punch-card sorter, or with electronic data processing equipment or computer programs. The system is stable and effective. (See also W71-12029) (Smith-PAI)
W71-13258

A DIGITAL COMPUTER TECHNIQUE FOR THE OPTIMAL CONTROL OF POLLUTANTS IN A CASCADED INPUT ESTUARY,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13273

DEVELOPMENT OF A WATER QUALITY CONTROL STRATEGY FOR RIVERS AND ESTUARIES USING HYBRID COMPUTER MODELING TECHNIQUES,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W71-13280

DIGITAL COMPUTER SIMULATION OF WASTE WATER TREATMENT,
Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 05D.
W71-13316

DIGITAL SIMULATION OF ACTIVATED SLUDGE SYSTEMS,
Kansas Univ., Lawrence.
For primary bibliographic entry see Field 05D.
W71-13348

DATA RELAY SYSTEM SPECIFICATIONS FOR EARTH RESOURCES TECHNOLOGY SATELLITE IMAGE INTERPRETATION,
Geological Survey, St. Louis, Mo.
For primary bibliographic entry see Field 07B.
W71-13460

THE ROLE OF REMOTELY SENSED AND RELAYED DATA IN THE DELAWARE RIVER BASIN,
Geological Survey, Harrisburg, Pa.
For primary bibliographic entry see Field 07B.
W71-13461

GEOLOGY AND GROUND-WATER RESOURCES OF GRANBY, MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W71-13480

THE GLACIAL RELIEF OF NORTH POLAND IN THE LIGHT OF THE DETAILED GEOMORPHOLOGICAL MAP OF THE POLISH LOWLAND IN 1:50,000 SCALE,
Polish Academy of Sciences, Warsaw. Inst. of Geography.
R. Galon.
In: Geographia Polonica, Vol 17, p 109-117, 1969. 1 ref.

Descriptors: *Maps, *Mapping, *Geomorphology, Quaternary period, Terrain analysis, Sedimentation, Erosion, Topography.
Identifiers: *Poland, Geomorphic maps.

The most important assemblages of Quaternary landforms on the glacial lowland of Poland are shown by means of a number of fragments of the recently published Detailed Geomorphological Map. The Polish Lowland contains all the most typical form assemblages produced by the Pleistocene glaciation and by postglacial relief-forming processes. The map, based on a geomorphological field survey, with a scale of 1:25,000, was compiled by the Department of Geomorphology and Hydrography of the Polish Lowland of the Geographical Institute of the Polish Academy of Sciences at Torum; this collective work of geographers from Torum, Poznan and Warszawa is meant to stress the characteristic features of a glacial landscape and its dynamic transformations during the Late-Glacial and Postglacial. (See also W71-13488) (Knapp-USGS)
W71-13489

QUALITY OF SURFACE WATERS OF THE UNITED STATES 1961: PARTS 3 AND 4, OHIO RIVER BASIN AND ST. LAWRENCE RIVER BASIN.
Geological Survey, Washington, D.C.

Geological Survey Water-Supply Paper 1882, 1968. 312 p, 1 fig.

Descriptors: *Water quality, *Water analysis, *Surface waters, *Ohio River, *St. Lawrence River, River basins, Chemical analysis, Analytical techniques, Sediment transport, Sedimentation, Particle size, Water temperature, Streamflow, Flow measurement, Hydrologic data, Data collections.
Identifiers: *Water quality (Basic data).

Quality of water data for the Ohio River Basin and St. Lawrence River Basin are presented for the 1961 water year (October 1, 1960 to September 30, 1961). The geological Survey maintained 141 stations on 88 streams for the study of chemical and physical characteristics of surface water. Samples were collected daily and monthly at 64 of these locations for chemical-quality studies. Samples were also collected less frequently at many other points. Water temperatures were measured daily at 114 stations. Quantities of suspended sediment are reported for 20 stations. Sediment samples were collected one or more times daily at most stations, depending on the rate of flow changes in stage of the stream. Particle-size distributions of sediments were determined at 19 of the stations. The stream discharges reported in the tables are either daily mean discharges or discharges for the time at which samples were collected. (Woodard-USGS)
W71-13512

STATISTICAL EXPERIMENTAL DESIGN: BOD TESTS,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05A.
W71-13528

COMPUTATION OF SUBARCTIC SURFACE WATER TEMPERATURES IN THE PACIFIC OCEAN IN WINTER,
For primary bibliographic entry see Field 02K.
W71-13617

WATER QUALITY SURVEILLANCE IN NEW YORK STATE,
New York State Dept. of Health, Albany. Div. of Pure Water.
For primary bibliographic entry see Field 05B.
W71-13631

COMPUTER PROGRAM FOR STATISTICAL ANALYSIS OF ANNUAL FLOOD DATA BY THE LOG-PEARSON TYPE III METHOD,
Minnesota Univ., St. Paul. Water Resources Research Center.
For primary bibliographic entry see Field 02E.
W71-13805

WATER TEMPERATURES OF CALIFORNIA STREAMS, SAN FRANCISCO BAY SUBREGION,
Geological Survey, Menlo Park, Calif.
J. C. Blodgett.
Geological Survey Open-file Report, 1971. 53 p, 4 fig, 1 tab, 24 ref.

Descriptors: *Water temperatures, *Streams, *Hydrologic data, *Data collections, *California, Reviews, Thermometers, Instrumentation, Surface waters.
Identifiers: *San Francisco subregion.

Water-temperature records collected through September 1969 are summarized for 87 stream sites in the San Francisco Bay Subregion of California. Current and historic stream temperatures are presented for correlating periodic and thermograph records and for analysis of the factors affecting these temperatures. The summary data for each site may be used to provide guidelines for the establishment of thermal standards used in water-quality management. Water temperatures, in degrees Celsius, are summarized by months, years, and for the period of record. A description is included to identify each station where data were collected. A tolerance interval analysis indicates that 99% of the point water-temperature observations, determined either with thermograph probes or hand-held thermometers, should be within 0.6 deg C of the mean water temperature at the 95% CONFIDENCE LEVEL. The probable total error ranges from 0.8 deg C for periodic data to 1.4 deg C for thermograph data. (Woodard-USGS)
W71-13825

MAINE BASIC-DATA REPORT NO 7, GROUND-WATER SERIES MEDUXNEKEAG RIVER - PRESTILE STREAM BASINS AREA,
Geological Survey, Augusta, Me.
G. C. Prescott, Jr.
Geological Survey Open-file Report, 1971. 2 fig, 6 tab.

Descriptors: *Data collections, *Water wells, *Maine, Hydrologic data, Geohydrologic units, Aquifer characteristics, Geologic formations, Logging (Recording), Water levels, Water chemistry.
Identifiers: Meduxnekeag River (Maine), Prestile Stream.

Data collections are presented in tables and on maps for selected wells and test holes in a 312 sq mi area of the drainage basins of Prestile Stream and Meduxnekeag River, northern Maine. The data include records of 167 wells and 25 test holes; logs describing the lithology of formations in 26 wells and test holes; detailed chemical analyses of 14 water samples; amount of water produced for public supply in the area; and water-level measurements made in one observation well. Information given in the well table includes location, owner, description of wells, well yield, water use, principal water-bearing material, and year well was drilled. Page-size maps show well and test hole locations. Map base is from reduced USGS 15-minute topographic quadrangles with 20-foot contour intervals. (Land-USGS).
W71-13826

PUBLIC AND INDUSTRIAL WATER SUPPLIES OF KENTUCKY, 1968-69,
Geological survey, Louisville, Ky.
For primary bibliographic entry see Field 06D.
W71-13829

GEOHYDROLOGY OF ATCHISON COUNTY, NORTHEASTERN, KANSAS,
Kansas Geological Survey, Lawrence.
For primary bibliographic entry see Field 04B.
W71-13842

DRAINAGE AREA OF LOUISIANA STREAMS,
Geological Survey, Baton Rouge, La. Water Resources Div.
R. Sloss.
Louisiana Department of Public Works Basic Records Report No 6, 1971. 117 p, 2 fig.

Descriptors: *Watersheds (Basins), *Runoff, *Hydrologic data, *Data collections, *Louisiana, Streams, Surface waters.
Identifiers: *Drainage area (Louisiana streams), Basic data.

The drainage areas (approximately 7000) are tabulated for streams in Louisiana where a meaningful topographic divide could be determined. Streams are listed in a downstream direction along the main stem, with all the tributaries entering the main stream in sequential order. The listing shows the drainage area of the main stem at the mouth of each named tributary and the drainage area for the tributary itself. As the stream pattern develops, downstream subtotals are cumulated to the mouth of the main stream. The drainage areas are tabulated to hundredths of a square mile. (Woodard-USGS)
W71-13848

WATER RESOURCES DATA FOR COLORADO: PART 2. WATER QUALITY RECORDS, 1970.
Geological Survey, Denver, Colo.

Available from Dist. Chief, WRD, USGS, Denver Fed. Center, Denver, Colo. 80225. Geological Survey Basic Data Report, 1971. 70 p, 1 fig, 17 ref.

Descriptors: *Hydrologic data, *Water quality, *Sediments, *Water temperature, Streamflow, Suspended load, On-site data collections, Colorado, Particle size, Chemical analysis, Gaging stations, Watersheds (Basins), Water chemistry.
Identifiers: *Water quality records.

Water quality information is presented for chemical quality, fluvial sediment, and water temperatures for stations in the Missouri, Colorado, Arkansas, Rio Grande, and Green River basins in Colorado. An index map shows locations of the data-gathering sites. Fluvial sediment information covers suspended sediment discharges and concentrations for particle size distribution of suspended sediment and bed material. Temperatures are once-daily observations except for stations with a continuous temperature recorder from which daily minimums and maximums are obtained. The location, drainage area, period of record, and extremes are given for each major observation station. Definitions are given of terms and abbreviations of water quality and hydrologic data as used in the text and tables of the report. (Lang-USGS)
W71-13858

DENSITY LOGS FROM UNDERGROUND GRAVITY SURVEYS IN HAWAII,
Hawaii Univ., Honolulu.
For primary bibliographic entry see Field 02F.
W71-13906

FLOODS OF DECEMBER 1964 AND JANUARY 1965 IN THE FAR WESTERN STATES, PART 2. STREAMFLOW AND SEDIMENT DATA,
Geological Survey, Washington, D.C.
A. O. Waananen, D. D. Harris, and R. C. Williams.
Available from GPO, Wash, D C, 20402-$3.50 paper cover. Geological Survey Water-Supply Paper 1866-B, 1970. 861 p, 8 fig.

Descriptors: *Hydrologic data, *Streamflow, *Sedimentation, *Floods, *Pacific Northwest U.S., Surface waters, Flow measurement, Gaging stations, Flow rates, Peak discharge, Discharge measurement, Stream gages, Data collections, California, Idaho, Nevada, Oregon, Washington, Sediment transport.

The floods of December 1964 and January 1965 in the Far Western States were extreme; in many areas, the greatest in the history of recorded streamflow and substantially greater than those of December 1955. An unusually large area--Oregon, most of Idaho, northern California, southern Washington, and small areas in western and northern Nevada--was involved. The total area encompassed about 200,000 square miles. Outstanding features included recordbreaking peak discharges, great volumes of runoff, high sediment concentrations, large sediment loads, and extensive flood damage. Basic records of stage, discharge, sediment concentration, and sediment load covered by this report were collected by the U.S. Geological Survey as part of a continuous program in cooperation with the States of California, Idaho, Nevada, Oregon, and Washington. The data consist of records of stage and discharge for gaging stations and for numerous miscellaneous sites and partial-record stations, and sediment concentration and

load for sediment stations and for some miscellaneous or periodic sites. The records are presented in more detail than those in the regular annual reports and hence are useful for the many hydraulic and hydrologic studies relative to flood phenomena. (Woodard-USGS)
W71-13932

A PROGRAM TO SIMULATE AN AQUIFER USING ALTERNATING DIRECTION IMPLICIT-ITERATIVE PROCEDURE,
Geological Survey, Washington, D.C.
T. Maddock III.
Geological Survey Report (Contributions to Computer Programs), August 1969. 73 p, 2 fig, 5 ref.

Descriptors: *Computer models, *Aquifer characteristics, *Simulation analysis, Data processing, Methodology, Application methods, Computer programs, Model studies, Transmissivity, Storage coefficient, Steady flow, Groundwater movement.
Identifiers: *Aquifer simulation, FORTRAN IV.

An aquifer simulation program to show aquifer response to pumping from one or more wells over a specific time period is written in FORTRAN IV for the IBM 360/65 computer. Aquifer behavioral characteristics and restrictions to make the program valid are described: the aquifer may be treated as a two-dimensional flow system; drawdown relative to saturated thickness is small; the storage coefficient is constant; boundaries may be irregular; transmissivity may be nonhomogeneous but isotropic; leakage may occur into the aquifer from lake or streambed, or from the confining area which may not have storage capabilities; the aquifer may have constant head or flow boundaries; pumping periods must be of equal intervals; and a well may occupy any node position of the grid imposed on the plan view of the aquifer. A description is given of the information and maps that can be printed as output information and maps that can be printed as output from the model. It is concluded that the drawdown map can be superimposed with the steady-state solution to produce actual drawdown configuration of the system. A 50 X 50 grid, with wells pumping a total of 20 yr, with annual changes in pumping rates, takes 4 minutes of computer time. (Land-USGS)
W71-13933

GENERAL SOIL MAPS - A STUDY OF LANDSCAPES,
Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 02G.
W71-13957

COMPUTER SYSTEMS FOR URBAN DESIGN AND DEVELOPMENT,
Skidmore, Owings and Merrill.
Niles O. Sutphin, William F. Sommerfeld, Lavette C. Teague, and Neil G. Harper.
Proceedings, American Society of Civil Engineers, Journal of the Urban Planning and Development Division, Vol 97, No UP1, p 63-78, April 1971. 7 fig, 12 ref.

Descriptors: *Computers, *City planning, *Urbanization, *Community development, *Computer models, Land-use, Mathematical models, Optimization, Program languages.
Identifiers: *Computer systems, *Urban design, Problem-oriented languages.

The paper reviews recent computer systems for modeling complex urban design and development problems. Urban games provide direct involvement in an operating model of urban situations. Alexander's pattern language states design requirements in a way which guides the selection of an appropriate urban form. Schlager's linear programming formulation of land use plan design illustrates the use of optimization models. Forrester uses a flow model to study urban growth and decay and to demonstrate the counter-intuitive dynamic behavior of complex urban systems. URBAN 5 and DISCOURSE are computer-aided design and information systems. The Planning and Land Use System (PLUS) generates alternative combinations of land uses satisfying development objectives, subject to a given set of planning standards. The use of PLUS is illustrated by an example. (Davis-Chicago)
W71-13961

COMPUTER METHODOLOGY AND WATER RESOURCE DEVELOPMENT,
Metcalf and Eddy, Inc., Boston, Mass.
For primary bibliographic entry see Field 06A.
W71-13974

WATER RESOURCES PLANNING MODEL, (A Technical Note),
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Building Research.
For primary bibliographic entry see Field 06A.
W71-13977

08. ENGINEERING WORKS

8A. Structures

DETERMINATION OF IN SITU STRESSES IN CONCRETE DAMS,
Bureau of Reclamation, Denver, Colo.
M. D. Copen and G. B. Wallace.
Proc Amer Soc Civ Eng, J Power Div, Vol 97, No PO2, p 455-473, Mar 1971. 19 p, 16 fig, 1 tab, 6 ref, 2 append.

Descriptors: Alkali aggregate reactions, Boreholes, Dam failure, Arch dams, *Concrete dams, Concrete tests, Concrete technology, *Field tests, Measuring instruments, Statistical analysis, *Stress analysis, Cracking, *In situ tests, Trial-load method, Deterioration, Strain gages, Stress relieving, Deformation.
Identifiers: Salt River Project, Ariz, Borehole deformation gage, *Overcoring method.

In situ stresses within 3 concrete dams on the Salt River above Phoenix, Ariz, were determined by application of a 3-directional borehole deformation gage. Two of the dams showed some signs of deterioration and structural cracking caused by alkali aggregate reaction, thus requiring stress determinations for safety evaluation. Information on in situ stresses in the other dam was needed for design of expanded power facilities. The stress relief method, its verification tests, and applications are examined. Best results for 3-dimensional stress analyses are obtained if the drill holes are orthogonal; however, a technique is presented for evaluating reliability of results obtained from having various orientations. The resulting stresses from the stress relief test are compared with those computed by the trial load method. Maximum water surface and minimum concrete temperatures were the loading criteria for both methods. The 6-in. overcores were tested in the laboratory to determine the ability of the concrete to resist in situ stresses.
W71-13152

NUMERICAL ERROR IN STRUCTURAL SOLUTIONS,
Stuttgart Univ. (West Germany).
J. R. Roy.
Proc Amer Soc Civ Eng, J Struct Div, Vol 97, No ST4, p 1039-1054, Apr 1971. 16 p, 2 fig, 3 tab, 9 ref, 3 append.

Descriptors: *Errors, Accuracy, *Structural analysis, Scaling, Foreign research, Numerical analysis, Computers, *Matrix algebra, Displacements, *Structural engineering, Finite element method, Mathematical analysis, Computation, Coordinates, Stiffness matrix.
Identifiers: Germany, Iteration method.

Numerical error may destroy the significance of the results of a structural analysis, particularly for certain classes of structures. The initial truncation error originating from representing each value of the structural matrices to constant computer word length approximates the total numerical error in the solution for displacements in medium-size problems. An upper bound for the error can be calculated readily, and is not too conservative when the global stiffness matrix is scaled before solution. When the error appears to large, only consistent higher precision representation and solution of the various structural matrices will ensure greater accuracy. The varying accuracy of the displacements caused by different loading conditions on the same structure is explained. The normal expression for the a posteriori error bound on the solution is unreliable because of the omission of the effect of initial truncation in representing the global stiffness matrix. Flexible areas within generally stiff structures, and stiff areas within generally flexible structures can lead to inaccurate solutions for displacements throughout the structure.
W71-13157

STOCHASTIC SEISMIC RESPONSE OF STRUCTURES,
Universidad Catolica de Chile, Santiago; and California Univ., Berkeley.
P. Ruiz and J. Penzien.
55 ref.

Descriptors: Stochastic models, *Stochastic processes, Bibliographies, *Dynamic response, Seismic design, *Structures, Earthquakes, Engineering mechanics, Hysteresis, Vibration, Vibration damping, Simulation, Seismic studies, Structural analysis, Ductility, Structural engineering, Seismic properties, Earthquake engineering.

Records of strong-motion earthquakes were simulated using a filtered shot noise. Twenty sample records were used to simulate the response of a structure subjected to earthquake excitation. The stochastic model used to generate the artificial ground acceleration records was designed to produce sample records similar to those of real strong-motion earthquakes of magnitude 8.3 recorded on firm soil at about 45 mi from the epicenter. A filtered shot noise was very suitable for the simulation. An 8-story shear-type building with inelastic force-deflection characteristics represented by a bilinear hysteretic model and having various values of stiffness and viscous damping was subjected to 20 samples of the artificial ground acceleration records. Major response parameters were evaluated and Monte Carlo estimates of the statistics of the parameters were obtained to allow predictions of their values during future earthquakes.
W71-13159

STRUCTURAL SECTIONS FROM REINFORCED PLASTICS,
Wisconsin Univ., Madison; and Koppers Co., Inc., Pittsburgh, Pa.
J. E. Johnson, J. Harris, and E. Hughes.
Prepr 1381, Amer Soc Civ Eng Nat Struct Eng Meet, Baltimore, Md, Apr 1971. 20 p, 8 fig, 3 tab, 5 ref, append.

Descriptors: *Structural members, *Structural shapes, Tests, Formulas, Structural design, *Reinforced plastics, Design criteria, Construction materials, Safety factors, Building materials, Mechanical properties, Polyester resins.

Developments in producing structural shapes made from fiber glass reinforced plastics provide design engineers with a new alternative in solving problems in situations concerned with chemically corrosive environments or conditions requiring electrical nonconductance. Advances in the state of the art in optimizing quantities of materials and placement of reinforcement have made reinforced plastic members economically feasible, and the ability of industry to produce members of high uniformity allows establishment of reliable design

criteria. An overall view of some parameters needed to select appropriate cross sections of reinforced plastic is presented. Tests developed to substantiate theoretically predicted results are summarized. Test results were in good agreement with theoretically predicted values. Design recommendations and safety factors applicable to simple structures are suggested.
W71-13164

ANALYSIS OF A PIPE WHEN IN CONTACT WITH THE OCEAN BOTTOM AND RIGIDLY FIXED AT ONE END,
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
Harry S. Georas.
Available from the National Technical Information Service as PB-202 986, $3.00 in paper copy, $0.95 in microfiche. Puerto Rico Water Resources Research Institute, Mayaguez, Completion Report UPRICO/WRRI/FR/71/9/1, June 1971. 25 p, 2 fig, 2 ref. OWRR A-C19-PR (1).

Descriptors: *Pipe, *Water currents, *Mathematical models, *Ocean bottom, Pipelines, Equations, Numerical analysis, Conduits.

A long pipe rests on the ocean bottom and it is gradually subjected to hydrodynamic forces due to water currents. Furthermore the motion of the pipe is resisted by soil reactions. The mathematical model for the plane deformation, consists of a nonlinear system of four ordinary differential equations, with four unknowns. To the system the appropriate boundary conditions at the two ends were added. The solution to the problem is connected to that of single nonlinear integral equation, which does not admit a closed solution. A closed solution is derived for the special case when the free end of the pipe is pulled through a given point. The solution is given in this case in terms of elliptic integrals of the first and second kind.
W71-13168

AQUEDUCTS FOR LEAST COST CONVEYANCE OF WATER, 37 DEG 32 FT N 45 DEG 5 FT E,
Rezaiyeh Coll. (Iran).
N. A. Christensen.
Proceedings, American Society of Civil Engineers, Journal of the Irrigation and Drainage Division, Vol 97, No IR3, p 483-499, September 1971. 3 fig, 2 tab, 10 ref.

Descriptors: *Aqueducts, *Canal design, *Tunnel design, *Pipelines, *Construction costs, *Water conveyance, *Fluid friction, *Unit costs, *Optimization, Economics, Energy gradient, Open channel flow, Mathematical models.

Equations were developed for determining the most economical size of round tunnels, pipelines and trapezoidal canals. To estimate the least cost size, the construction cost plus the fluid friction loss was expressed in terms of the aqueduct size and this function was minimized by differential calculus. One important dimension was found from which all the other characteristics of the most economical aqueduct were obtained. An example computation illustrated a hypothetical case. The author concluded that the design and size of any tunnel, pipeline or canal cross section may be represented by design factor D and one dimension to which all other dimensions were related thus permitting expression of the total cost in terms of the one important dimension. The algebraic expression of cost may then be differentiated with respect to the dimension and equated to zero resulting in the size of the least cost tunnel, pipeline or canal. By minor adjustments of the equations, both free surface flow and flow under pressure can be treated. (Markell-Cornell)
W71-13216

USE OF MONTE CARLO TECHNIQUES IN THE DESIGN AND OPERATION OF A MULTIPURPOSE RESERVOIR SYSTEM,
California Univ., Los Angeles. School of Engineering and Applied Science.
For primary bibliographic entry see Field 06A.
W71-13224

STATEMENT OF ENVIRONMENTAL IMPACT-BRANTLEY PROJECT, NEW MEXICO.
Bureau of Reclamation, Washington, D.C.

Available from the National Technical Information Service as PB-198 747-D, $3.00 in paper copy, $0.95 in microfiche. April 26, 1971. 13 p, 1 fig.
Identifiers: *Environmental surveys, *Dams, *New Mexico, Environmental surveys, Reservoirs, Irrigation, Flood control, Wildlife, Residential buildings, History, *Environmental impact statements, *Pecos River, *Brantley Dam, Major Johnson Springs.

The proposed Brantley Project--a dam and reservoir development--is on the Pecos River in Eddy County about 20 miles upstream from Carlsbad, New Mexico. The development would provide replacement irrigation storage for the McMillan Reservoir which is losing its effectiveness because of sediment accumulation. The plan of development for the project consists of the construction of Brantley Dam and associated reaction and fish and wildlife facilities. The reservoir would have a total capacity of 520,000 acre-feet. There will be an inundation of some productive lands and wildlife habitat. The project would displace about 15 families and require purchase of 59 sets of improvements such as residential buildings, farmstead, windmills, and irrigation pumps and ponds. The reservoir would inundate Major Johnson Springs, a historic locale in the area. These springs played an important part in the early history of the area.
W71-13477

STATEMENT OF ENVIRONMENTAL IMPACT-YELLOW CREEK PORT PROJECT.
Tennessee Valley Authority, Chattanoga. Office of Health and Environmental Science.

Available from the National Technical Information Service as PB-198 738, $3.00 in paper copy, $0.95 in microfiche. April 23, 1971. 10 p, 2 fig.
Identifiers: *Environmental surveys, *Harbor facilities, *Mississippi, Environmental surveys, *Land development, Construction, Sedimentation, Industrial buildings, Railroads, Dredging, Forests, *Environmental impact statements, Pickwick Lake, Tishomingo County, Mississippi.

The Yellow Creek Port Project is a cooperative undertaking among TVA, the state of Mississippi, and local governmental agencies for building and developing a river port terminal and related industrial complex on the Yellow Creek Embayment of Pickwick Reservoir in the northeast corner of Mississippi. The state will acquire and develop a minimum of 2,000 acres of land for use in industrial development in connection with the port and rail facilities. The environmental impact of the proposed action is foreseen to include possible temporary increased turbidity in the water near Yellow Creek embayment as a result of construction, and shifts in land usage from forest and rural to industrial. The unavoidable adverse environmental effects are expected to consist of temporary turbidity during dredging and construction.
W71-13478

STATEMENT OF ENVIRONMENTAL IMPACT-OVERLAND DITCH AND RESERVOIR COMPANY, HOTCHKISS, COLORADO, RECLAMATION PROJECT.
Bureau of Reclamation, Washington, D.C.

Available from the National Technical Information Service as PB-198 709-D, $3.00 in paper copy, $0.95 in microfiche. April 22, 1971. 5 p.
Identifiers: *Environmental surveys, *Dams, *Colorado, Environmental surveys, Construction, Reservoirs, Stream flow, *Environmental impact statements, Delta County (Colorado).

The Overland Ditch and Reservoir Company, Hotchkiss, Colorado, plans to replace the company's existing unstable Overland Dam on Cow Creek in Delta County, Colorado, by constructing a new, stable dam 1/4 mile downstream from the existing dam. No adverse environmental impact is foreseen. It was determined that the depletion of annual flows in the Gunnison and Colorado Rivers resulting from increased use of Cow Creek flows for irrigation will cause a very slight increase in concentration of dissolved solids in those streams.
W71-13479

CARRYOVER STORAGE REQUIREMENTS FOR RESERVOIR DESIGN IN MISSOURI.
Geological Survey, Rolla, Mo., Water Resources Div.
J. Skelton.
Missouri Geological Survey and Water Resources, Water Resources Report 27, August 1971. 55 p, 9 fig, 1 plate, 1 tab, 9 ref, append.

Descriptors: *Reservoir storage, *Reservoir design, *Storage capacity, *Water storage, Streamflow, Runoff, Hydrologic data, Data collections, Statistical methods, Analytical techniques, Water loss, Water yield, Missouri.
Identifiers: *Water storage requirements.

The carryover storage requirements for draft rates as high as 94 percent of the mean annual flow at 212 continuous and partial-record sites on unregulated Missouri streams are presented. The storage requirements were determined for selected chances of deficiency using the probability routing method and annual stream flows. These data will be useful in preliminary studies of storage structures to be located at or near gaged sites and in comparing development possibilities of different streams. Regional draft-storage curves for 2-, 5-, and 10-percent chances of deficiency are presented as three-parameter plots of storage against average annual runoff for selected draft rates. These curves can be used to estimate storage requirements at sites where long-time continuous records are not available. Standard errors of estimate for the curves are 20 percent or less. (Woodard-USGS)
W71-13505

UNDERGROUND CONSTRUCTION FEATURES AT NORTHFIELD,
Stone and Webster Engineering Corp., Boston, Mass; and Northeast Utilities Service Co., Hartford, Conn.
For primary bibliographic entry see Field 08H.
W71-13563

PREVENTION AND CORRECTION OF EXCESSIVE INFILTRATION AND INFLOW INTO SEWER SYSTEMS, MANUAL OF PRACTICE.
American Public Works Association, Chicago, Ill.

Copy available from GPO Sup Doc as SN 5501-0053, $1.25; microfiche from NTIS as PB-203 208, $0.95. Environmental Protection Agency, Water Quality Office, Water Pollution Control Research Series, January 1971. 131 p, 21 fig, 18 tab. Program No. 11022EFF, 14-12-550.

Descriptors: *Inflow, *Sewers, *Leakage, *Sanitary engineering, Joints (Connections), Piplines, Construction materials, Inspection, On-site tests, Specifications, Design standards, Cleaning, Repairing, Surveys, Economic impact.
Identifiers: *Construction practices, *Sewer infiltration, Sewer construction, Sewer testing, Sanitary sewers.

The manual is intended to serve as a guide to officials of local public agencies in evaluating sewer construction practices and in making field surveys

of infiltration of ground waters and inflows from various sources. Guidelines are also presented for making economic analyses of the cost of excessive infiltration and inflow, and for instituting corrective action. The problem is especially serious in the case of sanitary sewer systems in urban areas. Such systems are designed to carry only sanitary wastes, and a reasonable standard allowance is made for unavoidable entry of ground and surface waters. The illegal connection of roof leaders and foundation drains to sanitary sewer systems is the principal source of inflow. Infiltration usually results from poor construction practices or the use of inferior sewer pipe or jointing materials. Improvements in inspection of construction and testing of completed sewer lines will promote the use of better materials and good construction practices. The use of air for infiltration testing and water for exfiltration testing is described. Exerpts from sewer control legislation are given. Codes, standards, specifications, and suggestions for sewer design, construction, inspection, repair and cleaning are discussed. (Poertner)
W71-13568

GEOLOGY AND WATER WELL CONSTRUCTION,
Geological Survey, Norman, Okla. Ground Water Branch.
Stuart L. Schaff.
Journal of American Water Works Association, Vol. 42, No. 5, p. 475-478, May 1950.

Descriptors: *Water wells, Groundwater, Aquifer characteristics, Casing, Screens, Pumps, Water quality, Drilling.
Identifiers: *Water well contracts, Regional and local geology, Well yield, Pump selection.

The author of contract proposals for a water well is confronted by geologic considerations from the start. Location, depth, casing, screen, size of pump, testing, prevention of pollution, elimination of sand and turbidity--in each of these items some element of geology is involved. As the geologic conditions below any given point on the earth's surface generally cannot be predicted with complete accuracy, approximations to the right answers much suffice, but, without them, the writing of contract documents founders in uncertainties. The impact of geology is first felt when determining the location of a well. Regional stratigraphic geology is employed to show where rock formations likely to yield the required quantity and quality of water occur. The structure of those formations--including their dip, the folds in them and the faults that cut them into independent, offset blocks--shows the probable location of aquifers which are within the reach of drills andpumps. Knowledge of the geology of a proposed well site, including facts on the thickness, character and structure of rock formations and on the movement of water in them, is fundamental to the preparation of water well contract proposals. The more accurate the geologic information, the better the proposals can be made to fit the conditions and the more economically the work can be accomplished. (Campbell-NWWA)
W71-13711

WATER FROM WELLS,
Drayer-Hanson, Inc., Los Angeles, Calif.
G. E. Clancy.
Heating, Piping and Air Conditioning Journal, Vol. 19, No. 11, p. 75-79, November, 1947. 5 fig.

Descriptors: *Water wells, Groundwater, Well hydraulics, Drilling, Disposal wells, Pumps.
Identifiers: *Refrigeration, Plant water supply, Lateral well flow, Water temperature, Power requirements.

Water from wells has been used extensively in some localities for larger industrial applications of refrigeration--such as ice plants and cold storages--and for refrigeration plants for air conditioning. These cases of well water utilization are usually where the local conditions are so obviously favorable that they could not be overlooked. The advisability of using sea water, or water from lakes or from rivers, is usually quite apparent, for the temperature of the water is known or is readily ascertainable, as is also the location of the project with respect to the source of water supply (both as concerns elevation and horizontal separation). The case of wells is not so simple, for consideration must be given to a number of factors before the project is undertaken or even before its cost is estimated. These factors are often unknown but not always undeterminable, at least within limits satisfactory for determination of the advisability of the project and recommendation of the procedure to be followed. They include (1) the water level; (2) the amount of the water that can be pumped with a given drawdown. (Reduction of the level of the water in the well, while pumping below the normal water level, is independent of reduction due to depletion of supply; it is only the result of inability of water to flow the surrounding water bearing soil to the well without a considerable difference in level to cause the flow); (3) disposal of the water after it has been used; (4) the temperature of the water; (5) the quality of the water; (6) the reliability of the source. (Campbell, NWWA)
W71-13713

DRILLING SHALLOW SALT-WATER SOURCE WELLS,
Long Beach Oil Development Co., Calif.
E. T. Sullivan.
American Petroleum Institute: Drilling and Production Practice, 1960: p. 56-59, 1 fig, 1 tab.

Descriptors: *Water wells, Groundwater, Oil industry, *Drilling, Wells, Casing, Cement.
Identifiers: *Salt-water source wells, Gravel packing, Reverse-circulation drilling.

Water flooding has come of age in recent years in California and particularly in the Los Angeles Basin. The largest flood at present and destined to become the largest anywhere is in the Wilmington Field. Water flooding was initiated in the Wilmington Field during 1953 by the Long Beach Harbor Department through their contractor, the Long Beach Oil Development Company. During the launching of this pilot flood the question of water supply was thoroughly examined. Of the three general sources available--fresh, ocean, and produced--the fresh water was unusable because of incompatibility and the produced water, although sufficient in quantity for a pilot project, would require extensive treatment and would eventually, if the project were expanded, prove insufficient in quantity. The remaining source, ocean water, was available directly or from shallow sands which were ocean fed. The shallow sands were chosen because water taken directly from the bay was high in oxygen content and would also require filtering. The 'water-well' approach, using methods, equipment, and casing which were designed for shallow wells, has brought an economical, trouble-free solution to the salt-water requirements in the Wilmington Field water flood. (Campbell-NWWA)
W71-13714

DEVELOPMENTS IN THE DESIGN AND DRILLING OF WATER WELLS,
Western Well Drilling Co., San Jose, Calif.
Samuel T. Guardino.
Journal of American Water Works Association, Vol. 50, No. 6, p. 769-776, June 1958. 1 fig, 3 ref.

Descriptors: *Water wells, Rotary drilling, Drilling equipment, Logging (Recording), Casing Drilling fluid.
Identifiers: *Cable-tool drilling, Test bore, Gravel filter, Surface seal, *Well design, Reverse-circulation drilling.

In order of importance, the advantages of a properly constructed gravel envelope well are: (1) The same equipment is used to drill a test bore--which will accurately log formations encountered--as is used to complete the well. (2) Abandonment of a well for any reason is possible at relatively low cost because no material is involved before the well potential is determined. Further, well depth and absolute cost are ascertained before the use of any materials. (3) More efficient sealing from surface contamination or intrusion is possible. (4) Large diameter bores are possible; this insures admittance into the well of water from all horizons--including sandy formations which cannot be developed by a cable tool well. (5) Casing with machine-cut, milled perforations designed to the well characteristics can be installed in the proper position as indicated in the test bore or electric log. This assures entrance of a maximum supply of water into the well and a minimum drawdown while the velocity is retarded in order to reduce sand intrusion. (6) Rotary drilling equipment is more adaptable to drilling all types of formations--particularly those which may cause the immovability of cable tool casing that necessitates reduction of pipe diameter. Although a properly designed and constructed rotary-drilled gravel envelope well is the best medium for obtaining underground water, its efficiency is directly dependent on the competency of the well-drilling contractor performing the service. (Campbell-NWWA)
W71-13715

THE STATE OF ROCK MECHANICS KNOWLEDGE IN DRILLING,
Esso Production Research Co., Houston, Tex.
For primary bibliographic entry see Field 08E.
W71-13716

PERFORMANCE RECORDS OF RADIAL COLLECTOR WELLS IN THE OHIO RIVER VALLEY,
West Virginia State Health Dept., Charleston.
H. K. Gidley, and J. H. Millar.
Journal of American Water Works Association Vol. 52, No. 9, p. 1206-1210, September, 1960. 1 fig., 2 tab., 1 ref.

Descriptors: *Water wells, Groundwater, *Ohio River Valley, Specific capacities.
Identifiers: *Radial collector wells, Production capacities, Mineral content, Maintenance, Unconsolidated aquifers, Possible water supply polution.

Radial collector wells have been successfully used for the extraction of water from the unconsolidated alluvial deposits which occur in the Ohio River Valley in West Virginia. The 24 wells which have been installed in West Virginia indicate that an initial yield of 1.5-4.5 mgd can be expected from a well when the river is at pool stage. Reasonably accurate predictions of initial well yield at specific locations can be determined in advance by hydrologic studies. Considerable local variation in an aquifer is not unusual, and each well must be considered as an individual unit. The initial yield of most radial wells is not sustained with continued pumping, and the decline in production may be as much as 30-50 per cent in a 6-12-yr period. Silting of the river bottom and a resultant lowering of the aquifer recharge rate have been suggested by some as possible causes of the decline in yield. Restoration of well capacity has thus far not been attempted at the locations covered in this report. Water obtained from collector wells is clear, has excellent bacterial quality, is free of taste and odor, and has a fairly uniform temperature. Water from a well receiving most of its recharge by direct river infiltration has an average hardness comparable to that of the river. In some locations the chemical makeup of the water is materially influenced by the ground water in the vicinity. If objectionable amounts of iron or manganese are normally found in the aquifer at the well location, the presence of the iron or manganese in the well may persist for many years. (Campbell-NWWA)
W71-13720

TURBULENT STRUCTURE IN A TWO-DIMENSIONAL JET,
Wisconsin Univ., Madison. Water Resources Center.

Walter C. Mih.
Ph D Thesis, Water Resources Center, University of Wisconsin-Madison, 1970. 250 p, 64 fig, 11 tab, 103 ref. OWRR A-033-WIS (1).

Descriptors: *Flow, *Distribution patterns, *Continuity equation, *Turbulence, Electromagnet, *Discharge (Water), Jets, Velocity, Turbulent flow, Structures.
Identifiers: *Two-dimensional jet, *Navier-Stokes equation, *Gaussian distribution, Hybrid computer, Magnetohydrodynamics.

The research deals with the distribution of the mean and turbulent velocities and energy of a two-dimensional jet of water discharging into a large, stagnant body of water. In the theoretical phase, expressions for the lateral mean velocity distribution, the stream function distribution, the mean vorticity distribution, and the Reynolds' stress distribution have been obtained from the Navier-Stokes equations and the continuity equation, assuming a Gaussian distribution of the longitudinal mean velocity. In the experimental phase, a 900 gauss DC electromagnet was placed around a 4 inch wide, 23 inch high, and 48 inch long jet diffusion chamber. The jet discharge slot was 4 inch wide and 0.068 inch thick. Electromagnetic (or magnetohydrodynamics) probes were used to measure the turbulent velocities in the zone of established flow of the jet. The tape recorded signals were analyzed on a Hybrid Computer for variances of the turbulent velocities, autocorrelation functions, and spectral density functions. The intensity of turbulence in a water jet was found to have similar distribution to that of an air jet. However, the magnitude of the intensity of turbulence in a water jet is only approximately 1/3 the intensity of that in an air jet under the same mean flow conditions. Macro and micro scales have been calculated from the autocorrelation functions and were found to be nearly constant across a section perpendicular to the jet axis and to increase linearly with distance downstream of the point of discharge.
W71-13804

WILSON HARBOR, NEW YORK, 1968 PROJECT MODIFICATION.
Army Engineer District, Buffalo, N.Y.
For primary bibliographic entry see Field 04A.
W71-13879

PRELIMINARY DESIGN REPORT - URBAN STORM DRAINAGE - MODEL CITIES, DENVER - STUDY AREAS A,C,D and G.
Wright-McLaughlin, Engineers, Denver, Colo.

Waste Water Control Division, Department of Public Works, City and Council of Denver. January 1971. 93 p, 3 fig, 12 tab, 26 dwg, 1 append.

Descriptors: *Storm drains, *Planning, *Decision making, *Administration, *Management, Design, Engineering structures, Colorado.
Identifiers: Denver Model Cities program, Storm drainage system, Planning tool, Colorado drainage law, Urban drainage, *Denver (Colo).

The preliminary design for storm drainage in North Denver, study areas A, C, D and G, is presented in this report. Recently, planners and administrators have come to the conclusion that urban drainage is an important 'planning tool' in urban development. Wright-McLaughlin Engineers are convinced that the improved urban drainage system, when implemented in the study areas A, C, D and G, will result in a build-up of this rather run-down neighborhood, which consists of old residential areas, motels, commercial buildings, warehouses, and industry. Past surveys of American urban areas have indicated a possible direct relationship between the quality of the drainage system in an area, and the quality of the neighborhood. This relationship was considered in all stages of the planning process. Wright-McLaughlin Engineers present twenty alterations and suggestions to be considered in the design for storm drainage. An appendix details the important principles of the Colorado drainage law which is often misunderstood by engineers and planners. Understanding of the law is essential to good and successful decision making. (Strachan-Chicago)
W71-13884

THE ENGINEER AND SOCIETY,
For primary bibliographic entry see Field 06G.
W71-13891

NOTES ON THE EARLY HISTORY OF WATER-WELL DRILLING IN THE UNITED STATES,
Geological Survey, Tuscalossa, Ala.
C. W. Carlston.
Economic Geology, Vol 38, p 119-136, March 1943. 30 ref.

Descriptors: *Water wells, *Drilling, Drilling equipment, Casing, Oil industry.
Identifiers: Cable-tool drilling, Auger boring, Artesian aquifers, Salt wells.

The standard cable-tool drilling rig was invented and developed in drilling salt wells in the West Virginia-Ohio-Pennsylvania region during the twenty years following the successful completion of the first drilled well in 1808 by the Ruffner brothers at the Great Buffalo Lick near Charleston, West Virginia. Some time previous to 1823, Levi Disbrow studied the drilling methods used in the western salt industry and came east to become the first professional water well driller in the states north of the Potomac River. Possibly the first artesian water well in the United States was constructed in 1820 in Charleston, South Carolina, by sinking an iron pipe through a clay bed. Auger boring for artesian water appears to have been first used in Charleston, South Carolina, in 1823; however, the first successful auger-bored well was not completed in that city until after 1825. The drilling methods and tools were copied from a description of a well bored in London, England. Between 1821 and 1833 auger boring of artesian wells began in the Black Belt of Alabama and possibly in Mississippi. The process of jetting wells, invented in 1884, became the chief method of sinking artesian wells in the Atlantic and Gulf Coastal Plain by the end of the century. The first successful artesian wells in Georgia and Florida were put down during the period 1880-1882. (Campbell-NWWA)
W71-13966

HOW MANY INDIVIDUAL WELLS ARE CONTAMINATED.
Ground Water Resources Inst., Chicago, Ill.
For primary bibliographic entry see Field 05B.
W71-13967

FUNDAMENTALS OF WATER WELL OPERATION AND MAINTENANCE,
Universal Oil Products, St. Paul, Minn. Johnson Div.
E. W. Bennison.
Journal of the American Water Works Association, Vol 45, No 3, p 252-258, March 1953.

Descriptors: *Water wells, Drilling, Corrosion, Screens, Casing, *Operation, *Maintenance.
Identifiers: Deep rock wells, Shallow wells, *Well failures, Well longevity.

Good operation and maintenance of a well supply are primarily the well owner's responsibility. He must provide the best well construction, pumping equipment, and supervision that he can obtain. The operation and maintenance of a well water supply are a great responsibility, but municipalities, industries, and private owners often take it too lightly. They are not concerned until something unfortunate happens, but when a water supply fails, there are plenty of questions asked, with the blame usually falling upon the party least responsible. The author does not imply that the operator of a water well has no responsibility, for he has. His responsibility is to inform himself regarding the wells under his care. He must know enough about the methods and materials used in constructing wells to be able to anticipate any trouble from these sources. Furthermore, he should know enough about the local water-bearing formations and the water in them to be able to advise the owner of any over-pumping or reduction in supply. The operator should insist on having the apparatus and assistance required to make periodic readings of water levels, pumping levels, quantity of water pumped, and power consumption. It is essential to make these data a matter of record, because they will be invaluable in any emergency which might arise. Such information will also be helpful in anticipating shortages due to increased demands or failure of wells and pumping equipment. (Campbell-NWWA)
W71-13968

METHOD FOR DEEP WELL ALIGNMENT TESTS,
Eau Claire City Water Dept., Wis.
R. H. Jann.
American Water Works Association Journal, Vol 58, No 4, p 440-444, April 1966. 7 fig.

Descriptors: *Water wells, Drilling equipment, Casing, Data collections.
Identifiers: *Deep well alignment tests.

This article describes a convenient method for plotting and interpreting the results of deep well alignment tests. It is not intended that this method be used in place of methods, equally accurate and convenient, currently in use in some offices. It is common in making aligment tests, however, for persons to obtain accurate field data and to reduce the readings with mathematical precision, only to interpret the results with vague or inadequate methods. It describes methods used in making an alignment test of a deep well. The acquisition and mathematical reduction of field data are given briefly to provide background only, as the real intent of this article is to discuss the subsequent utilization of the data obtained. There are several methods of making field measurements to determine the location of the hole at any desired depth. The one described here is perhaps the most common. A heavy cylindrical plummet, having a diameter slightly smaller than that of the well, is suspended by fine wire from a point several feet above the top of the hole. The point of suspension, the apex, is then adjusted so that the plummet, when hanging freely, will be centered at the top of the hole. The plummet is then lowered into the hole, and, at 5- or 10-ft-depth intervals, the location of the wire at the top of the hole is measured from each of a pair of perpendicular index wires centered on the well casing. Given the height of the suspension point above the top of the well, the depth of the plummet, and the deviation of the wire at the top of the well in both the east-west and north-south directions, it is possible to compute the horizontal deviation of the plummet from an imaginary plumb line centered at the top of the hole for each of the perpendicular vertical planes. (Campbell-NWWA)
W71-13969

EXAMINATION OF DRILL CUTTINGS AND APPLICATION OF RESULTING INFORMATION TO SOLVING OF FIELD PROBLEMS ON THE NAVAJO INDIAN RESERVATION, N. MEX. AND ARIZ.,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W71-13970

USE OF INFLATABLE PACKERS IN MULTIPLE-ZONE TESTING OF WATER WELLS,
Geological Survey, Denver, Colo.
F. C. Koopman, J. H. Irwin, and E. D. Jenkins.
U.S. Geological Survey Prof. Paper 450-B, p B108-B109, 1962. 2 tab, 1 fig.

Descriptors: *Water wells, Drilling, Aquifer characteristics, Yield, Colorado.

Identifiers: *Multiple-zone testing, Straddle inflatable packers, Las Animas (Colo).

Packers have been used for many years in the testing and completing of oil wells, but have not been used extensively in testing water wells. Recent developments make the use of inflatable straddle packers feasible for testing sandstone and siltstone aquifers. One such test of aquifers of Permian to Cretaceous age near Las Animas, Colorado, is described in this paper. A test hole approximately 8 inches in diameter was drilled to a depth of 1,014 feet. Five zones, isolated by means of the packer assembly, were found to yield water. These zones included the Dakota sandstone, the Cheyenne sandstone Member of the Purgatoire Formation, part of the Morrison Formation, the Entrada Sandstone, and siltstones and sandstones of Triassic and Permian age. (Campbell-NWWA)
W71-13971

REGIONAL TRENDS IN WATER-WELL DRILLING IN THE UNITED STATES,
Geological Survey, Washington, D.C.
G. Meyer, and G. G. Wyrick.
U.S. Geological Survey Circular 533, 8 p, 1966. 2 tab, 3 fig, 8 ref.

Descriptors: *Water wells, *Drilling, *Regions, Costs.
Identifiers: National annual investment, National trends.

The well-drilling industry is one index of the importance of ground water to our national economy. National investment in water wells totals about one-half to three-quarter billion dollars annually. The overall industry is currently experiencing a sharp upswing in drilling activity, but activity varies from region to region. Regional changes in drilling activity are determined by regional changes in economy and development, population growth and shifts, changes in irrigation practice, and even natural phenomena such as earthquake and droughts. Analysis of estimates of the number of water wells drilled in the United States during the period 1960-64 reveals national and regional trends in water-well construction. Approximately 435,700 wells were drilled in 1964--an average of 1,700 well starts each working day. For the Nation as a whole, the net change between 1960 and 1964 was an increase of 14 percent in drilling activity. (Campbell-NWWA)
W71-13972

WATER WELL DRILLER'S BEGINNING TRAINING MANUAL.
National Water Well Association, Columbus, Ohio.

1971. 84 p.

Descriptors: *Water wells, *Drilling, *Drilling equipment, Drilling fluids, Screens, Casing, Aquifer testing, Rotary drilling, Cements, Pumps, *Publications.
Identifiers: Drilling safety, Cable-tool drilling, Air rotary drilling, Air hammer drilling, Reverse circulation, Jetting, Bored wells, Sealing, Well development, Well testing, Well records and reports.

The Water Well Driller's Beginning Training Manual is designed for use by water well contractors in the training of new men. It reduces to the barest essentials the knowledge a man must have in order to begin to learn how to be a water well driller. The manual, which consists of fifteen chapters, ranges from the simplest outline of ground water hydrology through the use of various types of drilling equipment for the construction of wells to the reasons for records and reports. The need for such a guidebook is well documented by a statistical analysis of the manpower shortage in the water well industry. Surveys show that the most widespread source of new workers are the contractors' own on-the-job training programs. This manual is designed for use with just such a program, no matter how informal it may be. The information presented represents a foundation on which each contractor can build the knowledge of new employees to suit his own operations. But it is a foundation only. Other more comprehensive books and manuals are designed to cover a wider range of water technology. The ruling principle here has been to envision a man with no prior knowledge of water well work at all. Emphasis is on strictly introductory material which the employing contractor can supplement according to his own desires and local conditions. (Campbell-NWWA)
W71-13973

8B. Hydraulics

SEDIMENT TRANSPORTATION MECHANICS: H. SEDIMENT DISCHARGE FORMULAS.
American Society of Civil Engineers, New York. Task Committee for Preparation of the Sedimentation Manual.

Proc Amer Soc Civ Eng, J Hydraul Div, Vol 97, No HY4, p 523-567, Apr 1971. 45 p, 24 fig, 3 tab, 39 ref, append.

Descriptors: *Bed load, Channels, Hydraulics, Rivers, *Sedimentation, Sediment load, Sediments, Streams, Sediment deposits, Laboratory tests, *Sediment discharge, *Sediment transport, Suspended sediments, Tractive forces, Saltation, Formulas, Graphical analysis, Mathematical analysis, Computer applications, Water temperature, Bibliographies.
Identifiers: Bed shear.

Thirteen well-known sediment discharge formulas are presented with a view toward making them convenient to use. The basis for each formula is outlined, and results of measured bed sediment discharge on 2 sand bed streams are compared with values calculated with each of the 13 formulas. Comparisons are made using graphs of sediment discharge against water discharge for the 2 streams. The relationships among water depth, velocity, and discharge were calculated by the Einstein-Barbarossa method. Comparisons of formula results with measurements and with each other point out the great variability of the calculated sediment discharges. However, the results are of only limited value in determining the general reliability of each formula.
W71-13162

SPILLWAY FOR WEST POINT DAM, CHATTAHOOCHEE RIVER, ALABAMA AND GEORGIA: HYDRAULIC MODEL INVESTIGATIN,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
Edwin S. Melsheimer and John L. Grace, Jr.
Available from the National Technical Information Service as AD-723 407, $3.00 in paper copy, $0.95 in microfiche. WES Technical report No 2-815, March 1968. 70 p.

Descriptors: *Spillways, *Dams, *Hydraulic models, *Model studies, Test procedures, Flow, Weirs, Stilling basins, Riprap.
Identifiers: Alabama, Georgia, West Point Dam, Chattahoochee River.

West Point Dam spillway was studied on a 1:60-scale comprehensive model and a 1:60-scale section model to determine flow conditions in the approach channel and performance of various elements of the structure. Modifications to both abutments were required to correct unequal distribution of flow that caused considerable turbulence and drawdown in the spillway bays adjacent to the abutments. Capacity of the spillway at the design pool was less than computed because of excessive losses at the abutments. Modification of the abutments furnished satisfactory capacity. Tests of the roller-bucket energy dissipator of original design were unsatisfactory. Three alternate basin designs were investigated, a slotted roller bucket and two apron-type basins utilizing one row of baffle piers and an end sill.
W71-13874

SPILLWAY FOR BIG BEND DAM, MISSOURI RIVER, SOUTH DAKOTA: HYDRAULIC MODEL INVESTIGATION.
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
E. S. Melsheimer.
Technical report, Rept No AEWES-TR-2-605, June 62. 63 p.

Descriptors: *Dams, *Hydraulic models, *Flow, Hydraulics, Structures, Test, South Dakota, *Spillways, Stilling basins, Procedures.
Identifiers: Big Bend Dam, Missouri River.

The spillway for Big Bend Dam was studied on a 1:60-scale model to determine flow conditions in the approach channel and the performance of the various elements of the structure. Particular emphasis was placed on the selection of a stilling basin which would operate satisfactorily with tailwater depths insufficient for ideal performance of a hydraulic-jump type basin.
W71-13881

ENERGY LOSS ANALYSIS FOR OPEN CHANNEL EXPANSIONS,
Colorado State Univ., Fort Collins. Coll. of Engineering.
G. V. Skogerboe, L. H. Austin, and R. S. Bennett.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY10, Paper 8464, p 1719-1736, October 1971. 18 fig, 10 ref, append. (Partially supported by funds from OWRR).

Descriptors: *Energy losses, *Open channel flow, Stilling basins, Critical flow, Subcritical flow, Nonuniform flow, Unsteady flow.
Identifiers: *Submerged flow, *Channel expansions.

A submerged flow analysis for open channel constrictions was modified to allow the analysis of energy loss on open channel expansions. The modified technique is compared with previous methods of analysis using existing data, along with data collected in the laboratory in open channel expansions with vertical walls and triangular-shaped baffles. These comparisons point out the limitations of existing methods of energy loss analysis. (Knapp-USGS)
W71-13915

PARAMETERS FOR BED SLIP POINT IN TWO-PHASE FLOW,
Queen's Univ., Kingston (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
W71-13916

FLOW VISUALIZATION IN TURBULENT BOUNDARY LAYERS,
Hong Kong Univ. Dept. of Mechanical Engineering.
J. A. Clark, and E. Markland.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 97, No HY10, Paper 8459, p 1653-1664, October 1971. 6 fig, 1 tab, 18 ref, append.

Descriptors: *Turbulent flow, *Turbulence, *Vortices, *Open channel flow, *Turbulent boundary layers, Boundary layers, Dimensional analysis, Hydraulic models, Sediment transport.
Identifiers: Flow visualization.

Visual observation of flow in a fully developed turbulent boundary layer along a two-dimensional channel reveals the presence of systematic vortices both in the longitudinal and the transverse directions. In some cases a pair of longitudinal vortices are connected together by a transverse one in a horseshoe configuration. As the vortices are convected downstream they grow and decay, finally dispersing as new structures are formed. These vortex structures are analyzed in terms of the wall layer parameters. (Knapp-USGS)
W71-13917

8C. Hydraulic Machinery

SURGE TANK STABILITY BY PHASE PLANE METHOD,
International Power and Engineering Consultants Ltd., Vancouver (British Columbia); and British Columbia Univ., Vancouver.
M. H. Chaudhry, and E. Ruus.
Canada.

Descriptors: Discharge (Water), Gates, *Gate control, Analysis, *Surge tanks, Hydraulics, Powerplants, *Oscillations, *Stability, *Mathematical studies, Surges, Equations, Foreign research, Turbines, Governors, Fluid mechanics, Graphical analysis, Penstocks.
Identifiers: Canada.

When the flow in the penstock of a hydroelectric powerplant is changed, the water level in the surge tank starts to oscillate. These oscillations are stable or unstable, depending on the parameters of the plant and the type and magnitude of the disturbances. Using the phase plane method, the stability of oscillations in a simple surge tank is studied for: (1) constant flow; (2) constant gate opening; (3) constant power; and (4) constant power combined with constant gate opening. Several quantitative results are obtained from the analysis of singular points. A number of phase portraits are presented to show the effect of the changes in different parameters on the qualitative behavior of the system.
W71-13163

ENGINEERING FEASIBILITY STUDY OF THE BISHOP SYSTEM FOR OPEN OCEAN OIL SPILLS.
Bishop (William R.) and Associates, San Francisco, Calif.
For primary bibliographic entry see Field 05G.
W71-13296

A STUDY TO DEVELOP A PROTOTYPE EMERGENCY WATER SUPPLY PLAN: METROPOLITAN WATER SYSTEM OPERATION SUBSEQUENT TO NUCLEAR ATTACK OR NATURAL DISASTER,
Texas State Water Utilities Dept., Dallas.
Dan A. Brock.
Office of Civil Defense, Final Report, May 1970. 364 p, 6 fig, 29 tab, 7 ref. Interservice Support Agreement 68-001. PH 110-68-38.

Descriptors: *Disasters, *Planning, *Simulation analysis, *Computer models, *Water supply, Operations, Operations research, Texas, Civil defense, Burning, Electric power failure, Networks, Mathematical models, Water distribution (Applied).
Identifiers: *Emergency water supply plan, *Nuclear attack, Vulnerability, Water system simulation.

The operation is evaluated of the Dallas water system subsequent to 4 nuclear attacks. The study was extended to examine probable availability of electric power, probable effect on supplies of chemicals and stores, and on communications. A methodology is developed for creation of a plan for operation of a metropolitan water system subsequent to nuclear attack or natural disaster. Automatic digital computer water system simulation is used to determine the ultimate overall effect that damage to components produces in the water system operation. Hypothetic attack data supplied by the National Civil Defense Computer Center is used with the simulation model in making dynamic vulnerability analyses of the water system. Problems of unmanned water purification plants and availability of electric power are considered. The study confirmed the utility of possessing alternate water supply sources in each pressure zone. Frequently service could be maintained over most of a pressure zone even when one pump station feeding it had been destroyed or cut off from electric power. Simulation studies of partially destroyed water systems should be extended to all cities of the United States over about 50,000 population. (Poertner)
W71-13560

REPORT ON OPERATIONS CONTROL CENTER FOR THE WATER UTILITY DEPARTMENT OF THE CITY OF DALLAS, TEXAS.
Black and Veatch Consulting Engineers, Kansas City, Mo.
For primary bibliographic entry see Field 05F.
W71-13567

RECOVERY OF OIL SPILLS USING VORTEX ASSISTED AIRLIFT SYSTEM,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
For primary bibliographic e try see Field 05G.
W71-13896

FINAL REPORT AND EVALUATION OF EXPERIMENTAL TOWERS IN THE 230-KV GLEN CANYON-SHIPROCK TRANSMISSION LINE,
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
Harry Brenman.
Available from the National Technical Information Service as PB-196 976. $3.00 in paper copy, $0.95 in microfiche. Report REC-ERC-71-3, Jan 1971. 19 p, 15 fig, 2 tab.

Descriptors: *Transmission towers, Transmission lines, *Erection, *Guyed towers, Helicopters, Cranes (Hoists), Costs, Reliability, Design, Feasibility, Investigations, Experimental data.
Identifiers: Test transmission lines, *Self-supporting towers.

Results of a 6-year investigation program of new tower designs and erection procedures for transmission lines are reported. The 7-mile test section of a 230-KV transmission line near Kayenta, Arizona, consisted of 4 towers each of 7 different types, some erected by cranes and some by helicopter. Installed cost data are given. The 6-year service reliability was satisfactory for this experimental section of transmission line. Feasibility of helicopter erection was satisfactorily demonstrated. Tower designs based on guyed construction were acceptable. Self-supporting towers were found to be most economical. Environmentally, use of guyed towers should be avoided near substations, highways, or in agricultural fields. Basic design data of the transmission line and tower design data are given.
W71-13903

8D. Soil Mechanics

CONSTRUCTION OF EARTH DAMS ON PERMAFROST SOILS,
N. G. Trupak.
Hydrotech Constr, No 9, p 7980803, Sept 1970. 6 p, 3 fig, 4 ref.

Descriptors: *Earth dams, *Permafrost, Foreign construction, Freezing, *Frozen soils, Thawing, Dam foundations, Dam failure, Sheet piling, Heat transfer, *Seepage, Soils, *Soil stability, Settlement (Structural), Dam construction, Glacial soils, Refrigeration, Cold climates, Cutoffs.
Identifiers: USSR.

Industrial developments in the northeast and far north of the USSR necessitate construction of earth dams with foundations in permafrost soils. Permafrost soils may be rock and loose soils held together with ice, or may be silt-covered, powdery sandy loams. Seepage occurs when rocks are in the foundation of the dam and the interlayers of ice thaw. Loams lose stability when the ice thaws. As the reservoir forms behind the dam, permafrost soils in the bed of the reservoir thaw rapidly and in time so do the soils under the base of the dam. The problem is being solved by using metal sheet piling with a concrete core and cutoff or by keeping the soil in the body of the dam in a frozen state. Freezing the soil in the core, downstream slope, and the base of the dam is accomplished by natural or artificial cooling. Three methods have been used: (1) the core is maintained in a frozen condition throughout the life of the dam by using a refrigeration plant; (2) the soil of the core is frozen by artificial cooling and the downstream slope by natural cooling, and upon coalescence of the frozen zones the refrigeration plant ceases to operate and is kept on standby; and (3) the core of the dam and the downstream slope are frozen by natural cooling.
W71-13153

USE OF WATER TEMPERATURE STUDY TO DEFINE SEEPAGE PATHS,
Corps of Engineers, Baltimore, Md.
W. B. Trautwein.
Eng Geol, Vol 7, No 1 and 2, p 11-20, Fall 1970. 10 p, 8 fig.

Descriptors: *Water temperature, *Seepage, Seepage control, Isotherms, Thermometers, *Thermistors, Dams, *Underseepage, Joints (Geology), Field investigations, Piezometers, Groundwater, Temperature sensors, Grouting, Probes (Instruments), Foundations, Reservoirs.
Identifiers: Temperature distribution.

A water temperature study to determine the paths of underseepage of reservoir water through a dam uses an electric-resistance thermometer with a direct reading dial that indicates temperatures from zero deg F to 122 deg F and a sensitivity of one-half deg F. Assuming that dams with underseepage problems generally have installed piezometers, the holes for taking water temperatures will already be present in the suspected areas. Temperatures of the reservoir from top to bottom, and any seeps downstream of the structure must also be determined. Isotherms may then be drawn for the temperatures found. Used in conjunction with standard piezometric studies, the method was very successful in defining the zone of underseepage on Alvin R Bush Dam in central Pennsylvania. The piezometers showed seepage near the left abutment. The water temperature study established that: (1) seepage was from the foundation rock into the embankment; (2) jointing controlled the seepage path; (3) the path was relatively direct; and (4) seepage occurred within the top 15 ft of the foundation rock. The information obtained from such a temperature study indicates whether remedial treatment is needed and, if so, what kind.
W71-13156

DYNAMICS OF EARTH DAMS WITH FOUNDATION INTERACTION,
California Univ., Berkeley; and South Dakota School of Mines and Technology, Rapid City.
A. K. Chopra and P. R. Perumalswami.
Proc Amer Soc Civ Eng, J Eng Mech Div, Vol 97, No EM2, p 181-191, Apr 1971. 11 p, 5 fig, 2 tab, 17 ref, append.

Descriptors: Dams, *Earth dams, *Dynamics, Damping, Natural frequency, Earthquakes, Foundations, Vibration, Analytical techniques, Engineering mechanics, Finite element method, Bibliographies, Vibration damping, Dynamic response.

An analytical procedure to determine the dynamic properties (natural frequencies, mode shapes, and radiation damping) of dams, including foundation interaction effects, is presented. The dam-foundation system is idealized as a plane strain problem. The dam is represented as an assemblage of 2-dimensional finite elements, and the foundation is considered as an elastic half space. The procedure is used to determine the dynamic properties of earth dams, including foundation interaction effects for different values of the ratio of foundation to dam elastic modulii and dam geometry. The numerical results indicate that: foundation interaction

may have significant influence on the frequencies and made shapes of vibration of earth dams; influence of foundation interaction depends significantly on the geometry of the earth dam cross section, being relatively more important for dams with flatter side slopes; and magnitudes of radiation damping computed for idealized dam-foundation systems seem unrealistically large. Further research is needed to obtain realistic estimates of radiation damping.
W71-13158

LANDSLIDES ALONG THE ILLINOIS RIVER VALLEY SOUTH AND WEST OF LA SALLE AND PERU, ILLINOIS,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 02J.
W71-13853

8E. Rock Mechanics and Geology

INVESTIGATION OF THE LONG-TERM STABILITY OF RESINCAPSULE ROCK BOLTS IN NAVAJO SANDSTONE,
Bureau of Reclamation, Denver, Colo.
C. W. Cozart.
Pap, Div Design, Bur Reclam, Denver, Colo, Jan 1971. 4 p, 1 fig, 3 ref.

Descriptors: *Rock bolts, *Field tests, Stability, *Epoxy resins, Test procedures, Relaxation (Mechanics), Loads (Forces), Loading tests, Rock mechanics, Anchor bolts.
Identifiers: Navajo sandstone, Load cells.

Six resin-capsule, 1-in.-dia rock bolts were tested to determine their long-term stability. The bolts were installed in the Navajo sandstone at Glen Canyon Dam, Ariz. Load cells for the bolts were calibrated for 10 loads ranging from 0 to 25,000 lb. Initial loads on the bolts varied from 9,000 to 12,000 lb. Two bolts were not anchored properly to the rock and would not accept the desired load. Load-time graphs are presented from the time of initial loading in Oct 1968 to Dec 1970. Load cells showed a load relaxation in the bolts for 11 days after loading; relaxation varied from 17 to 44% of the initial load. Loads carried by the bolts dropped slightly over a 1-yr cycle of temperature stressing, but leveled out in subsequent years. Results of the investigation show that properly installed resin-capsule anchors will provide an anchorage in Navajo sandstone for loading a 1-in.-dia rock bolt to approximately 10,000 lb.
W71-13154

THE STATE OF ROCK MECHANICS KNOWLEDGE IN DRILLING,
Esso Production Research Co., Houston, Tex.
W. C. Maurer.
Symposium of Rock Mechanics, 1966, University of Minnesota, School of Mineral and Metallurgical Engineering, Minneapolis, Minnesota, Chapter 15, p. 355-395, 55 fig, 2 tab, 71 ref.

Descriptors: *Rock mechanics, *Drilling, Drilling equipment, Mechanical properties, Rock properties.
Identifiers: *Novel drilling methods, Rock failure, Mechanical drills, Drilling rate equations.

Although millions of feet of rock are drilled annually, the basic drilling mechanisms involved are not well understood. The primary reason for this lack of knowledge is because the basic principles of rock failure are not well understood and rock failure is the primary mechanism in drilling. A better understanding of the drilling mechanisms would enable a more scientific approach to the design and use of drills and bits. The paper reviews several models which have been proposed to explain various aspects of the different drilling methods. These models are described and their limitations and areas of application are discussed. Drilling rate relationships are developed and related to the basic rock failure mechanisms. (Campbell-NWWA)
W71-13716

STIMULATING HARD ROCK WATER WELL PRODUCTION WITH HIGH EXPLOSIVES,
A. E. Mills.
Water Well Journal, Vol. 24, No. 2, p. 39-42, February, 1970. 1 fig., 3 ref.

Descriptors: *Water wells, Aquifer characteristics, Rock mechanics, Mechanical properties.
Identifiers: *Blasting, *Shooting, *Aquifer stimulation, Hydraulic fracturing, Chemical explosives, Safety, Detonation, Cistern construction.

Shooting (blasting) is considered in the hard mountain granites and other types of clean, hard, elastic, well consolidated, brittle rock aquifers that fracture like glass. Shooting has no value and is of no benefit in stimulating overly clay-filled sandstones, conglomerates, gravels, loose sands, etc. This type of material is plastic (not elastic), will not rebound, will not fracture, but will only plastically deform like a child's mud pit under confined triaxial impulse loading. Water wells in this material are destroyed by shooting. The first oil well shot with high explosives to stimulate greater production was around 1863 in the shallow, hard rock oil sands of Pennsylvania. When the wells were shallow, the pulverized rock debris was self-cleaned from the hole along with the water stemming (hole full of water for momentary confinement purposes) by the explosive gases. For shooting purposes, water wells in the Rockies can be classified as shallow. This article is concerned only with shooting shallow hard rock water wells or low cost construction of large cisterns. With the evolution of the drilling industry, the holes became deeper and deeper, and eventually passed the self-cleaning depth. Deep wells resulted in long, expensive cleanouts of the fine shattered, pulverized rock debris. Thus mechanical (pump) hydraulic fracturing was developed. (Campbell-NWWA)
W71-13718

8F. Concrete

DETERMINATION OF IN SITU STRESSES IN CONCRETE DAMS,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08A.
W71-13152

PROPOSED ACT STANDARD: RECOMMENDED PRACTICE FOR CURING CONCRETE.
ACI Committee 308.

J Amer Concr Inst, Proc, Vol 68, No 4, p 233-243, Apr 1971. 11 p, 15 ref.

Descriptors: *Concrete technology, *Concrete construction, Fog-curing, Concrete pavements, Concrete properties, *Curing, Precast concrete, Mass concrete, *Curing compounds, Standards, Concretes, Construction, Sealing compounds, Reinforced concrete, Slip forms, Bibliographies, Cold weather construction, *Moisture content, Temperature, Shotcrete.
Identifiers: Concrete slabs, Hot weather construction.

Curing is defined as the process of maintaining a satisfactory moisture content and a favorable temperature in concrete during hydration of the cementitious materials so that desired properties of the concrete are developed. Two systems of providing the required moisture are: (1) maintaining a moist environment by application of water; and (2) preventing loss of mixing water by use of sealing materials. Basic principles of successful curing are outlined, and commonly accepted methods, procedures, and materials are described. Recommendations are given for curing: (1) pavements and other slabs on ground; (2) structures and buildings; and (3) mass concrete. For each of these categories, methods, materials, time, and temperature of curing are recommended. Comments are given on curing requirements for precast products, shotcrete, preplaced aggregate concrete, refractory concrete, and plaster.
W71-13161

8G. Materials

INVESTIGATION OF THE LONG-TERM STABILITY OF RESINCAPSULE ROCK BOLTS IN NAVAJO SANDSTONE,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08E.
W71-13154

STOCHASTIC SEISMIC RESPONSE OF STRUCTURES,
Universidad Catolica de Chile, Santiago; and California Univ., Berkeley.
For primary bibliographic entry see Field 08A.
W71-13159

STRUCTURAL SECTIONS FROM REINFORCED PLASTICS,
Wisconsin Univ., Madison; and Koppers Co., Inc., Pittsburgh, Pa.
For primary bibliographic entry see Field 08A.
W71-13164

HIGH TEMPERATURE ELECTROCHEMICAL STUDY OF ALUMINUM ALLOYS FOR DESALINATION EQUIPMENT,
Reynolds Metals Co., Richmond, Va.
W. H. French, and J. S. Snodgrass.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price $1.00. Office of Saline Water Research and Development Progress Report No. 688, May 1971. 96 p, 54 fig, 5 tab, 11 ref. OSW Contract 14-01-0001-2301.

Descriptors: *Desalination, *Aluminum alloys, *Aluminum corrosion, *Cathodic protection, *Electrochemistry, Velocity, Cathodic control, Corrosion, *Corrosion control.
Identifiers: Weldments, Cold-Work, Sacrificial anodes, Chlorides, Time-potential-temperature correlations.

The electrochemical behavior of a number of candidate aluminum alloys was studied under the conditions of water chemistry and temperature found in the MSF distillation desalination process. The study was conducted in several basic areas which included time-potential-temperature behavior, effect of velocity, weldment performance, effect of cold work on potentials, polarization effect of reduced oxygen level, and the economics of impressed current versus sacrificial anode cathodic protection systems. Significant results were obtained from the time-potential-temperature tests which indicated a metastable potential for magnesium-containing alloys with greater than 0.9 percent magnesium. The effects of velocities within the operating range of heat exchangers were found to be insignificant when compared with temperature effects. Base-metal weld-metal combinations were found which did not corrode at high temperatures. Amount of cold work was found to have little effect on potential. Polarization studies showed that cathodic control prevailed in the presence of chlorides, while in high-purity product water mixed control predominated. The effects of reducing dissolved oxygen to the 200 ppb level were not significant. (Filban-Office of Saline Water)
W71-14000

8H. Rapid Excavation

A METHOD FOR ESTIMATING EFFECTIVE POROSITY IN A RUBBLE CHIMNEY FORMED BY AN UNDERGROUND NUCLEAR EXPLOSION,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 07B.
W71-13463

UNDERGROUND CONSTRUCTION FEATURES AT NORTHFIELD,
Stone and Webster Engineering Corp., Boston, Mass; and Northeast Utilities Service Co., Hartford, Conn.
J. M. Missel and George B. Brosky, Jr.
1971. 21 p, 13 fig, 1 tab.

Descriptors: *Rock excavation, *Tunneling, *Shafts, *Pumped storage, *Underground powerplants, *Drilling equipment, Drill monitors, Drilling, Rock mechanics, Rock bolts, Mining Engineering, Hydroelectric plants, Explosives, Massachusetts.
Identifiers: *Rapid excavation, *Raise-bore method, *Northfield Mountain Powerplant, Hard rock excavation.

The Northfield Mountain Pumped Storage Project will have the first underground hydroelectric powerhouse of its type, the most sophisticated governor system and, when completed, will be one of the largest pumped storage plants in the world. This 90-million dollar project was conceived by the Northeast Utilities Service Company, with design and construction management being supplied by Stone and Webster Engineering Corporation. The low bidder for the construction contract was Morrison-Knudsen Northfield Assoicates, a joint venture by Morrison-Knudsen, Perini, and Brown and Root. The project basically consists of an upper reservoir, intake channel and structure, pressure shaft which diverges into four penstocks, underground powerhouse with four 250 megawatt reversible pump-turbine/generator-motors, hydraulic surge system and a tailrace tunnel and canal leading to the lower reservoir which is formed in the Connecticut River by the Turners Falls Dam. The power house, which is located 700 feet below the surface of Northfield Mountain, is 328 feet long, 70 feet wide and 155 feet high. It was excavated in a hard granitic gneiss. In addition, pressure and vent shafts and 3 1/2 miles of tunneling, varying in size from 26 to 38 feet across, were excavated in rock. Excavation was conducted by the drill-and-blast method employing specially designed equipment and unique excavation procedures. An ingenious approach using the raise-bore method, was employed in excavating the ventilation and pressure shafts. Techniques are described. (Poertner)
W71-13563

STIMULATING HARD ROCK WATER WELL PRODUCTION WITH HIGH EXPLOSIVES,
For primary bibliographic entry see Field 08E.
W71-13718

8I. Fisheries Engineering

THE COMMERCIAL FISHERY FOR FRESHWATER CRAWFISH PACIFASTACUS LENIUSCULUS (ASTACIDAE), IN OREGON, 1893-1956,
Nat. Mar. Fish. Serv., Trop. Atl. Biol. Lab., Miami, Fla. Tropical Atlantic Biology Lab., Miami , Fla. National Marine Fish Service.
George C. Miller, and Jack M. Van Hyning.
Res Rep Fish Comm Oreg. 2 (1): 77-89. Illus. Map. 1970.
Identifiers: Astacidae, Catch, Commercial, Consumption, Crawfish, Fishery, Fresh, Human, Oregon, Pacifastacus-Leniusculus, Pacifastacus-Leniusculus-Leniusculus, Pacifastacus-Leniusculus-Towbridgii, Seasonal, USA, Water.

A minor fisher has existed for fresh-water crawfish in Oregon since 1893. Annual landings, which reached a maximum of 176,000 lb in 1930, have fluctuated considerably throughout the history of the fishery. P. leniusculus leniusculus. P. leniusculus trowbridgii, and integrades between these 2 sspp. are taken primarily in the Willamette River tributaries and in the Columbia River below Portland, Oregon. Only a small percentage of the incoming year class of crawfish enters the trap fishery, probably because the juveniles and adults differ in food habits. In the fishery for human consumption, the fishermen select crawfish more than 3 1/2 in. in body length; for bait, smaller crawfish are retained. The catch is seasonal, with the largest landings in June to Nov. Most female crawfish are at least 17 mo. old before they bear eggs. The weight-length relationship and length-frequency distributions of a single sample of P. l. leniusculus are given.–Copyright 1971, Biological Abstracts, Inc.
W71-13140

PREDATION BY SCULPINS ON FALL CHINOOK SALMON, ONCORHYNCHUS TSHAWYTSCHA, FRY OF HATCHERY ORIGIN,
National Marine Fisheries Service, Seattle, Wash. Biological Lab.
Benjamin G. Patten.
Special Scientific Report-Fisheries No 621, February 1971, 14/2. 6 fig, 11 ref, 9 tab. Available from the National Technical Information Service as COM-71-00642, $3.00 in paper copy, $0.95 in microfiche.

Descriptors: *Chinook salmon, *Sculpins, Fisheries, *Predation, Fish migration, Fry, Fish hatcheries.
Identifiers: *Aquaculture.

Predation was studied during migration of the fry towards the Columbia River from two hatcheries--the Elokomin River Hatchery (13 km. upstream from the Columbia) and the Oxbow Hatchery on Herman Creek (0.2 km. upstream). In the Elokomin River the estimated loss of hatchery salmon to sculpins, Cottus spp., was 3.9 percent of 1.5 million fry released in 1962 and 1.3 and 3.6 percent of 2.2 and 0.1 million fry, respectively, released in 1963. Loss was negligible among 2.3 million fry released in Herman Creek in 1962. Sculpins that preyed on hatchery salmon were coastrange sculpin, C. aleuticus; prickly sculpin, C. asper; reticulate sculpin, C. perplexus, and torrent sculpin, C. rhotheus; in the Elokomin River and prickly and reticulate sculpins in Herman Creek. Predation was greatest by prickly sculpin (the largest species) and least by coastrange sculpin (a species with a comparatively small mouth). Losses of salmon to sculpins may have been related to diet and to the size of the releases. In the Elokomin River, predation was greater on salmon fed a wet diet than on those fed moist pellets. The larger of the two releases in 1963 had the smaller percentage loss. Improvement of hatchery procedures is probably the best way to reduce losses of hatchery-reared salmon to sculpins.
W71-13371

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

ANNUAL REPORT, 1970-1971.
Arizona Univ., Tucson. Environmental Research Lab; and Arid Lands Research Center, Abu Dhabi (Trucial Oman).
For primary bibliographic entry see Field 02I.
W71-13569

WATER RESOURCES CENTER, ANNUAL REPORT, 1 JULY 1969 - 30 JUNE 1970,
California Univ; Los Angeles, California. Water Resources Center.
For primary bibliographic entry see Field 09D.
W71-13570

9D. Grants, Contracts, and Research Act Allotments

WATER RESOURCES CENTER, ANNUAL REPORT, 1 JULY 1969 - 30 JUNE 1970,
California Univ; Los Angeles, California. Water Resources Center.
A. F. Pillsbury.
University of California, Water Resources Center, Report No 21, September 1970. 203 p. OWRR A-999-CAL (5).

Descriptors: *Annual, *Projects, *Investigations, *Publications, Precipitation (Atmospheric), Evaporation, Transpiration, Groundwater, Plants, Chemical reactions, Hydrologic cycle, Desalination, Water yield improvement, Water conservation, Agriculture, Water management (Applied), Environmental effects, Water quality control, Resources, Planning, Engineering, History, Watershed management, *California.

Progress reports during the 1969-70 fiscal year for 62 studies by the University of California Water Resources Center are presented. Subject headings for these studies are: the nature of water, the water cycle, water supply augmentation and conservation, water quality management and control, water quality management and protection, water resources planning, resources data, and engineering works. The progress reports include data such as topic classification, project name, principal author and affiliation, data and funding, summary, and publications. Some reports have tables and figures. (Popkin-Arizona)
W71-13570

10. SCIENTIFIC AND TECHNICAL INFORMATION

NATURAL OIL SEEPS IN OR NEAR THE MARINE ENVIRONMENT: A LITERATURE SURVEY,
Coast Guard, Washington, D.C. Applied Chemical Oceanography Branch.
For primary bibliographic entry see Field 05B.
W71-13297

URBANIZATION AND SEDIMENTATION - A BIBLIOGRAPHY.
Office of Water Resources Research, Washington, D.C. Water Resources Scientific Information Center.
For primary bibliographic entry see Field 02J.
W71-13432

REMOTE SENSING BIBLIOGRAPHY FOR EARTH RESOURCES, 1969,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07B.
W71-13442

A STATE-OF-THE-ART REVIEW OF METAL FINISHING WASTE TREATMENT.
Batelle Memorial Inst., Columbus, Ohio. Columbus Labs.
For primary bibliographic entry see Field 05D.
W71-13514

A REVIEW OF LITERATURE ON INORGANIC NITROGEN METABOLISM IN MICROORGANISMS,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 05C.
W71-13541

EVAPORATION AND TRANSPIRATION,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 02D.
W71-13810

WASTEWATER REUSE,
National Water Commission, Arlington, Va.
For primary bibliographic entry see Field 05D.
W71-13871

GROUNDWATER MANAGEMENT IN DEVELOPMENT OF A NATIONAL POLICY ON WATER,
National Water Commission, Arlington, Va.
For primary bibliographic entry see Field 04B.
W71-13872

PRECIPITATION MODIFICATION,
National Water Commission, Arlington, Va.
For primary bibliographic entry see Field 03B.
W71-13873

WATER QUALITY CRITERIA FOR EUROPEAN FRESHWATER FISH - EXTREME pH VALUES AND INLAND FISHERIES,
Food and Agriculture Organization of the United Nations, Rome (Italy). European Inland Fisheries Advisory Commission.
For primary bibliographic entry see Field 05C.
W71-13893

SUBSURFACE WASTE DISPOSAL BY MEANS OF WELLS--A SELECTIVE ANNOTATED BIBLIOGRAPHY,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05E.
W71-13909

GASES AND ODORS FROM POULTRY MANURE: A SELECTED BIBLIOGRAPHY,
Merck and Co., Rahway, N.J. Quinton Research Labs.
For primary bibliographic entry see Field 05B.
W71-13987

SUBJECT INDEX

ABLATION
ON THE ORIGIN OF ABLATION HOLLOWS (POLYGONS) ON SNOW,
W71-13640 02C

ABNORMAL FLUID PRESSURE
PERMEABILITY CONSIDERATIONS IN GENERATION OF ABNORMAL PRESSURES,
W71-13614 02F

ABSORPTION
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A. Center of Competence		
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- Ground and surface water hydrology at the Water Resources Division of the U. S. Geological Survey, U. S. Department of the Interior.

- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

- Eastern United States water law at the College of Law of the University of Florida.

- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.

- Water resources economics at the Water Resources Center of the University of Wisconsin.

- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.

- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the EPA-Water Quality Office, Soap and Detergent Association, and the Agricultural Research Service.

- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

- Water well construction technology at the National Water Well Association.

- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.

- Textile wastes pollution at the School of Textiles of North Carolina State University.

- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.

- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.

- Agricultural livestock wastes at the Department of Agricultural Engineering of Iowa State University.

- Methods for chemical and biological identification and measurement of pollutants at the Analytical Quality Control Laboratory of the Water Quality Office of the Environmental Protection Agency.

- Coastal pollution at the Oceanic Research Institute.

- Water treatment plant waste pollution control at American Water Works Association Research Foundation.

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

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